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THE UTILIZATION OF PEAT.

By Samuel L. Jodidi, Ph.D., Chemical Laboratory, Michigan Agricultural Experiment Station.

(Read at the Annual Convention of the American Peat Society, Toledo.O.)

No modern industry is conceivable without fuel. The iron, steel, copper, in short any metal industry rests upon the presence of fuel. Moreover, their development is directly proportional to the amount of available fuel: the cheaper, nearer and in greater abundance it is to be had, the larger dimensions will these industries reach in a given period of time. The same is true, though in a different degree, of the sugar, glass, cotton, paper and of any modern industry. It is, therefore, not to be wondered at that of late among other objects the fuel question has drawn the attention of the whole nation. The conference on the conservation of natural resources which took place in May, 1908, at the White House, revealed a number of facts of the utmost importance to the vital interests of the country. From the very highest authorities we learned that owing to the wasteful and irrational methods of their exploitation, the forests—the best natural moisture holding means—in many parts of the country have decreased to such an extent as to seriously affect climate, navigation and agriculture in the regions in question. Likewise we have been told by the most reliable experts that as a consequence of the same extravagant modes in coal mining and consumption the original supply of coal in this country is very materially diminishing from decade to decade. While there is no immediate danger for the present as well as for the next few generations as far as coal supply is concerned, the price of coal naturally so advances as to be felt

already for the time being, by reason of the partly disappearing mines and increased coal consumption.

It is true that some of the remedies recommended by the recent national conference, as re-forestation of the country, economic exploitation of timber, as well as rational and careful methods in mining and consumption of coal will be of great benefit to the people and, first of all, postpone the exhaustion of the coal supply. It is also true that extensive utilization of the waterways of the country, instead of railroads, will materially reduce the coal consumption. But on the other hand it is surprising that in the face of the so serious question of coal production and consumption very little, if indeed anything, has been done for the utilization of another fuel so abundant in this country, namely the peat. In the peat bogs nature has freely stored up a vast amount of carbon and nitrogen which when worked will considerably increase the actual wealth of this country. This may be better comprehended when expressed in figures. It is for this reason that we have made some calculations which may not be out of place.

It is estimated for the state of Michigan, the area of which equals 58,915 square miles, that swamp lands largely covered by peat and muck form one-seventh* of the entire area of the state. With these figures in mind and under the assumption, rough as it is that one-tenth of it or roundly 1½ per cent of the total area consists of workable peat, the calculation is based on our analytical results given below. Further, taking into consideration that good peat deposits in Michigan have a depth of not less than 60 to 70 feet, as against from one to a few feet in shallow peat beds, it is within reason to assume that the average depth of the workable peat bogs is more than ten feet. Nevertheless we used in our calculations the average depth of only ten feet to be conservative and for the further reason that peat bogs are usually worked to this depth. Thus:

Area of workable peat bogs in Michigan (1½% of the total area)................	565,584 acres
Fresh peat (of average sp. gr. 0.85) per acre —foot	1,154 tons
Fresh peat per acre and for the depth of 10 ft.	11,540 tons
Air-dry peat** per acre—foot...............	204 tons

*See "Peat Essays on its Origin, Uses and Distribution in Michigan," by Charles A. Davis, page 289.

**The average water content of fresh peat is about 85%, hence 15% of dry substance. The average water content of air-dry peat is approximately 15%, hence 85% of dry substance. Since the weight of peat decreases proportionately to the amount of water removed, or in other words, since the weight of peat is inversely proportional to its dry substance content, we find that the amount of air-dry peat per acre—foot equals 1,154× 15/85=204 tons.

Air-dry peat per acre × 10 ft. depth........ 2,040 tons
Air-dry peat for total area..................1,153,000,000 tons
Gross value of peat fuel per acre × 10 ft. depth........$ 6,120
Net value of peat fuel per acre × 10 ft. depth..........$ 3,060
Gross value of peat fuel for total area..........$3,459,000,000
Net value of peat fuel for total area............$1,729,000,000
The cost of producing the fuel, from $1 to $2 per ton, will be distributed among the people as skilled and unskilled labor, technically trained men, manufacturers of peat machines and so forth.

As far as abundance of peat is concerned, all that has been said of Michigan is also true in a high degree of New England and of a number of the middle and northwestern states. For the United States it is estimated that the combined peat bogs will yield far above 20 billion tons of dried peat, which is equivalent to at least 10 billion tons of good soft coal.

Important as it is as fuel, yet the value of peat as fertilizer should not be underestimated. In many cases it is probably of higher value as fertilizer than as fuel. This is especially true of peat with considerable nitrogen content. The analysis given below shows that the one sample of Michigan peat contained 2.25% nitrogen and the other sample 2.70%. There are, of course, in this country peats with much higher as well as with lower nitrogen content. Our analytical results taken as basis for the calculations, we arrive at the following figures:
Nitrogen per acre—foot.........................***3.9 tons
Nitrogen per acre × 10 ft. depth.................. 39 tons
which is equivalent to 236.8 tons of nitrate of soda.
Nitrogen for the total area....................22,000,000 tons
which is equivalent to 133,000,000 tons of nitrate of soda.
Gross value of peat as fertilizer per acre × 10 ft. depth..$11,700
Gross value of peat-nitrogen for the total area.$6,617,000,000..
So we see that in the case of the analyzed samples the value of peat as fertilizer is pretty nearly twice the value of peat as fuel. It must, however, be borne in mind that only a very small part of the nitrogen content of the peat can be considered as immediately available, the greatest part of the nitrogen contained in the form of organic compounds is not available at present, but may gradually under favorable conditions be converted into nitric acid through the action of micro-organisms and thus into available plant food. The above figures speak a decided language and give some idea as to the magnitude of

***There are per acre—foot 204 tons of air-dry peat with 85% dry-substance, hence 204×85/100=173.4 tons of water-free peat. Taken as average nitrogen content the sample with poorer percentage of nitrogen, i. e., 2.25%, we find 173.4×2.25/100=3.9 tons.

the problems confronting the state of Michigan and the country at large in connection with the peat question.

From the standpoint of fuel utilization it is in the last analysis carbon and hydrogen, the combustion of which produce the heating effect. And these elements are contained in the peat just as well as we find them in wood, lignite, coal and anthracite, the only essential difference being the higher amount of moisture in the peat as it is dug from the bog. However, the moisture can conveniently be removed by exposing it to the air or the sun, or it can be accomplished though at higher cost, by artificial means, so that the resulting peat contains from about 10 to 20% of water. The heating value of such peat equals at least half the value of good bituminous coal, as can be seen, for instance, from analysis of Michigan peat recently made by us.

A sample of brown peat from Chelsea, county of Washtenaw, Michigan, has been found to have the following composition:

Carbon	56.87%	in oven-dried peat
Hydrogen	5.43%	" " "
Nitrogen	2.25%	" " "
Oxygen	29.83%	" " "
Surphur	0.35%	" " "
Ash	5.27%	" " "
Moisture	82.81%	in fresh peat

The corresponding figures for the air-dry peat are as follows:

Carbon	51.76%	in air-dry peat
Hydrogen	4.94%	" " "
Nitrogen	2.05%	" " "
Oxygen	27.15%	" " "
Sulphur	0.31%	" " "
Ash	4.80%	" " "
Moisture	8.99%	" " "

Another sample of peat in the shape of briquettes from the Commercial Artificial Fuel Company, Toledo, Ohio, producing peat fuel in the factory near Lambertville, Michigan, showed the following composition:

Carbon	52.59%	in oven-dried peat
Hydrogen	4.72%	" " "
Nitrogen	2.70%	" " "
Oxygen + Sulphur		
Ash	9.90%	" " "

The figures for the air-dry peat are as follows:

Carbon	46.56%
Hydrogen	4.18%
Nitrogen	2.39%
Oxygen + Sulphur	
Ash	8.77%
Moisture	11.46%

Thus, in the first place the percentage of ash is low. This is also true, in a still higher degree, of the sulphur content. Since the ash decreases the value of a fuel as it must be raised to the temperature of the burning fuel and maintained at this temperature, since further the sulphur burning to sulphur dioxide attacks the grates and boilers, the fact of low ash and sulphur content very materially speaks in favor of Michigan peat as a fuel. On the other hand the water content of Michigan bog peat as well as of peats generally speaking, is very high. It would be, of course, out of the question to use fresh peat directly from the bog as fuel, but the water, as already mentioned, can be removed in the most convenient and cheap way by drying the peat in the air, or still better, in the sun. It is evident that a peat as fuel has the more value, the higher is its carbon and hydrogen content and the smaller its moisture and ash percentage. Our analytical results given above are fully sufficient to determine the calorific value of the peat, using the scientifically accurate data obtained for the calorific value of pure carbon, hydrogen, sulphur and water. These data show that—

1 kilogram of carbon gives in burning to CO_2... 8,080 calories
1 kilogram of hydrogen generates in burning to H_2O (†) ....28,800 calories
1 kilogram of sulphur generates in burning to SO_2 .... 2,500 calories

while 1 kilogram of water uses in round numbers 600 calories in order to be converted into steam. A great number of exact experiments have shown that the calorific value of peat, or generally of fuel, equals the sum of the calorific values of its carbon, hydrogen and sulphur contents minus the heat used for converting the moisture into steam. So developed the so-called Dulong's formula:

$$\frac{8{,}080\ C + 28{,}800\ (H - O/8) + 2{,}500\ S - 600\ W}{100},$$

C, H, O, S and W being the percentages of carbon, hydrogen, oxygen, sulphur and water in the peat. Calculating according to this formula the heating value of the first peat sample, we find:

†Whereas the water (H_2O) is supposed to escape as vapor.

$$\frac{8{,}080\times 51.76+28{,}800\ (4.94-27.15/8)+2500\times 0.31-600\times 8.99}{100}=$$

4,582 calories.

The second sample of peat fuel in briquettes calculated in the same manner gives the following figures:

$$\frac{8{,}080\times 46.56+28{,}800\ (4.18-26.64/8)-600\times 11.46}{100}=$$

3,938 calories.

The figures 4,582 and 3,938 calories represent, of course, the theoretical thermal value. Actually there is always loss of heat through radiation, imperfect combustion, further through the hot gases going up the chimney, and so forth. Practice has shown that only about two-thirds of the theoretical heat can be utilized for heating purposes, so that the two samples of Michigan peat woud allow to utilize 4,532×2/3—3,055 and Michigan peat would allow to utilize 4,532×2/3=3,055 and 3,938×2/3=2,625 calories respectively. Now, the amount of heat required to convert 1 kilogram of water into steam is in round numbers 600 calories, or can be very accurately calucu-lated by means of Regnault's formula:

$L=-(606.5+0.305t)$. In this formula L expresses the amount of heat necessary to convert 1 kilogram water of O° C. into steam of t° C. For instance, the quantity of heat to convert 1 kilogram water of 25° C. into steam of 225 lbs. pressure or, what is about the same, of 200 C. would be:

$L=-(606.5+0.305\times 200)+25$ (initial temperature of the water) $=-642.5$ calories. Consequently, 1 kg. or 1 lb. of peat of the 1st sample can evaporate $\frac{3{,}055}{642.5}=4.8$ kgs. or lbs. of water. For the second sample of peat briquettes we find $\frac{2{,}625}{642.5}=$ 4.1 kgs. or lbs. of water. This will be better comprehended bearing in mind that 1 lb. of good soft coal can evaporate about 8 lbs. of water. For instance, a Pennsylvania coal analyzed by us in the sugar factory at Croswell,** Mich., and calculated according to the above formula, furnished 7,485 calories. This divided by 642.5 gives $\frac{7{,}485}{642.5}=11.6$, and two-

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**See "Fuel Economy in Sugar Factories," by Samuel L. Jodidi, page 14.

thirds of it equals $11.6 \times 2/3 = 7.7$ lbs. In other words, 1 lb. of the Pennsylvania coal was able to convert into steam 7.7 lbs. of water. Hence, the value of the Chelsea peat is $4.8 \times \frac{100}{7.7} =$ 62.3% and the value of the briquetted peat of the Commercial Artificial Fuel Company is $4.1 \times \frac{100}{7.7} = 53.2\%$, the value of the Pennsylvania coal.

A further examination of the data obtained by our analyses leads to the following conclusions: The fact of the low ash percentage is a very important quality of the Michigan peat as fuel not only because under equal conditions the loss of heat is the smaller, the lower the ash percentage, but also because the expenses for transporting and working peat fuel are naturally the smaller the less ash it contains. A peat with, say 25% ash can hardly be used with advantage as fuel, and a peat with 50% ash is generally spoken of as muck soil which can be used advantageously for agricultural purposes. Again, the low sulphur percentage is another property of the Michigan peat to be appreciated, not merely because a fuel with higher sulphur contents corrodes the iron bars of the grates and the plates of the boilers, endangering thus their use, but for the reason that it does considerable damage to plants as well. It is on account of this fact that the legislatures in Germany compel manufacturers burning fuels with considerable sulphur percentage, or producing chemicals under development of sulphur dioxide, to construct very high chimneys carrying off the injurious gas as far from the plants as possible. On the other hand the water content of fresh peat as dug from the bog is very high, varying from 80 to 90%, our own analysis showing a water percentage of 82.81. It goes without saying that it is impracticable to use peat with such water content as fuel, nor can it be used in this shape as fertilizer, as in the first case the amount of available heat would be too small, and in the second case the working and transportation of a fertilizer with nine-tenths of water and only one-tenth of dry substance would be too expensive and its application hard to accomplish. Fortunately air and sun—though the latter in a more limited degree—are to be had without cost, and these agents proved to be very efficient in carrying off the water from the peat, so that in a few days the fresh peat can be reduced to from 10 to 25% moisture. In the above analyses the peat with 8.99% moisture was dried by us artificially in an electric drying oven at a temperature of about 40° C.,

which temperature can be often observed in the sun during the summer, and another peat with 10.85%*** moisture was obtained by drying at the room temperature. Of course, by applying the compression or condensation method for the preparation of a marketable peat fuel it is quite possible to dry it artificially so as to make it practically free of water. But aside from the fact that this would cause higher expenses, it must be borne in mind that, as practice has shown, a fuel burns better when containing some moisture. Then, too, even the best kinds of bituminous coal contain a certain percentage of water.

Nor is the utilization of peat limited to its application as fuel and fertilizer. There is very little doubt but that peat is going to play a considerable role in creating chemical industries. Space does not permit to go into details of this interesting question. Generally speaking organic matter like wood, peat, lignite or coal when subjected to the so-called destructive distillation yields charcoal or coke, then tar, tar water and gaseous products. Of course, all the solid, liquid and gaseous products vary qualitatively and quantitatively in a considerable degree, depending upon the materials used, the temperature applied and upon the length of time during which the materials are subjected to destructive distillation. While the tar water obtained from bituminous coal contains ammonia as main product, it consists in the case of wood of acetic acid and wood alcohol. The reason why there is no ammonia obtained in the latter case is easily comprehended when we recall that wood consists chiefly of cellulose and does not contain any nitrogen. It is, then, natural to suppose that peat, the chemical composition of which is somewhat in the middle between wood and coal, yields at the dry distillation process some products contained in the tar water of coal as well as of wood. This is indeed actually the case: ammonia, acetic acid and methyl alcohol are the chief constituents of peat tar water. The percentage of the products obtained by the dry distillation of peat is in round numbers as follows:

Peat coke, from	25 to 30%
Tar, about	4%
Tar water, about	40%
Gas, from	20 to 30%

While the gas can be used for heating, illuminating or power purposes or, as is usually the case, for heating the furnaces where the coking of peat takes place, the chemicals con-

***This determination is not contained in the analyses given above.

tained in the tar water are unquestionably of considerable interest. This is first of all true of the ammonia, the recoverable amount of which depends in the first place upon the percentage of nitrogen in the peat, and in the second place upon the methods applied. Dr. Caro is responsible for the statement that by means of the Mond process, entirely modified and perfected by him, the total amount of nitrogen in the peat can practically be obtained in the shape of ammonia. This absorbed in sulphuric acid is then recovered as sulphate of ammonia representing a valuable fertilizer. Now, in 1907, the production of coal in the United States was in the neighborhood of 450,000,000 tons. Since the total supply of coal in this country is estimated to be in round numbers 2,000,000,000,000 tons and the total supply of air-dry peat is at least 20,000,000,000 tons, or a ratio of 100 to 1, it is reasonable to assume that we could or should at present work 4½ million tons of dry peat per annum. Taking as basis the poorer sample of Michigan peat with 2.05% nitrogen content in the air-dry state, we find that the total quantity of nitrogen with the mentioned yearly production of peat would be $4,500,000 \times 2.05/100 = 92,250$ tons. As with the Mond-Caro process we are able to recover at least 50% of the nitrogen in the form of ammonia—to be conservative—it means that 46,125 tons nitrogen could be converted completely into sulphate of ammonia. A simple chemical calculation shows that 7 tons of nitrogen furnish 33 tons of ammonium sulphate, hence the 46,125 tons nitrogen would yield $46,125 \times 33/7 = 217,446$ tons of pure ammonium sulphate representing a gross value of about 17,000,000 dollars. According to Dr. Caro, the total cost for the treatment of 100 tons of dry peat, including wages, sulphuric acid, amortization, etc., is 125 dollars, while the value of the ammonium sulphate alone is 325 dollars, thus allowing a considerable profit. However, this calculation is true for a peat with 1.62% nitrogen in the dry substance, and it is a matter of course that peats with higher nitrogen content, as was actually the case with the two Michigan peat samples analyzed by us, would yield an amount of ammonium sulphate having a considerably higher value than 325 dollars and leaving a correspondingly greater profit.

Again taking the yearly production of peat mentioned above as basis and recalling that the quantity of obtainable acetic acid is roundly 0.2% of the peat, we obtain: $4,500,000 \times 0.2/100 = 9,000$ tons or 18,000,000 pounds of acetic acid, representing a value of $300,000. Equally since the percentage of crude wood alcohol recoverable from peat is about 0.15%, we find $4,500,000 \times 0.15/100 = 6.750$ tons, or about

13,500,000 pounds, having a value of $700,000.

The question naturally arises as to whether the sulphate of ammonia, acetic acid and wood alcohol, that could be obtained from the peat, would find a ready market. Let us for this purpose consult the most authoritative source at our command, viz.: the statistical data of the Department of Commerce and Labor. In the latest Bulletin 92, "Census of Manufactures, 1905, Chemicals and Allied Products," on page 12 we read:

Ammonia, aqua used in 1900, 16,185,257 lbs., valued at..$	547,040
Ammonia, aqua used in 1905, 26,249,683 lbs., valued at	878,992
Ammonium sulphate used in 1900, 8,493 tons, valued at	657,726
Ammonium sulphate used in 1905, 16,216 tons, valued at	956,965
Wood alcohol used in 1900, 3,692,803 gal., valued at.....	1,751,345
Wood alcohol used in 1905, 7,591,772 gal., valued at.....	3,084,380

On page 13 we read that the amount of acetic acid produced was:

In 1900.............26,660,565 lbs., having a value of $426,892
In 1905.............27,001,322 lbs., having a value of $537,542

On the same page we read that the quantity of acetate of lime produced from wood distillation was:

In 1900..............43,413 tons, having a value of $ 981,286
In 1905..............52,571 tons, having a value of $1,474,982

Hence, in all the items cited, the increase in the value of the products ranges from 25 to 76%. We thus see that while the quantity of acetic acid and wood alcohol obtainable from 4½ million tons of dry peat does not by far cover the amount of these chemicals used or produced in 1905, the recoverable quantity of sulphate of ammonia is too large. True, side by side with the fertilizers and chemicals obtainable from peat they will be recovered also from coal and wood. But on the other hand the increase in their demand is growing from year to year, as we have seen from the statistical data. This is especially true of the ammonia. On page 50, table 66, of the cited bulletin we read that the quantity of ammoniated superphosphates was:

In 1900............143,648 tons, having a value of $ 2,462,888
In 1905............781,354 tons, having a value of $13,020,825

or an increase in five years of more than 400 per cent! The production and consumption of the other chemicals are also increasing, although not so rapidly. No one can doubt that the application of fertilizers, first of all of those containing ammonia—the most important of all—will continue to extend in the future. Why? Because the increase in population through natural augmentation and immigration, the necessity of application of intensive methods instead of extensive ones, the diminution of the area of the so-called virgin soils will bring

about such condition. In addition the higher intelligence and progressive agricultural training of the farmers as well as recognition of the fact that plant food taken from the soil in the shape of crops must be returned, very conveniently in the form of fertilizers, is one more weighty reason for the above statement.

Space does not permit to speak of other commercial products, important as they are, as paraffin, oils, etc., obtainable from peat through dry distillation. However, the facts mentioned already strongly impress us with the desirability, even with the necessity of exploiting the peat bogs representing a certain part of the wealth of this country. Why is it, then, that up to the present time so very little, if indeed anything, has been done for the utilization of the peat occurring in many states of this great republic? A brief consideration of the beet sugar industry, only recently developed, though at a first glance not having any relation to the peat question, may be instructive for answering the topic. The history of the beet sugar industry shows that its pioneers have been struggling hard for a number of years, apparently with no prospect of success in this country. All the earlier costly experiments and attempts of raising sugar beets and manufacturing beet sugar proved to be a complete failure. The tonnage was small, the quality of the beets poor, the sugar manufactured left much to be desired. The main causes were lack of interest on the part of farmers who were too slow to take up with raising a new crop. deficient knowledge in both beet growing and sugar manufacturing. But owing to the efforts of a few pioneers as well as to the work of the experiment stations, interest and knowledge gradually spread among the people. It was, however, not until the Oxnards—experts and champions of the beet sugar industry—had constructed and successfully operated two or three sugar factories, that the beet industry was finally established and from very modest beginnings developed in about two decades to its present size. Twenty years ago there was practically no beet sugar industry in this country. Now there are 63 factories cutting yearly in round numbers 3,600,000 tons of beets and turning out 421,000 tons of sugar valued at $40,000,000. Twelve years ago the beet industry was not yet born in Michigan. Now this state has 16 factories in successful operation, cutting from 700,000 to 750,000 tons of beets and producing 90,000 tons of sugar having a value of $8,550,000.

It is striking how similar are the causes of a general nature that retarded the establishment of the beet sugar industry and are hindering now from creating and developing the peat industry. It seems to us that the failure of some attempts to utilize

the peat bogs is the most discouraging one. But such attempts have never been made beyond the experimental stage. It is true that this country has in great abundance coal from which coke, gas and ammonia are obtained in considerable quantities, and there are skeptics enough who believe that in the face of the coal supply the peat industry is not going to have a success. But it is equally true that the beet industry has been created and developed despite the existing powerful cane sugar industry. It is equally correct that lack of interest on the part of the people, as in the case of the beet industry, as well as ignorance of the real facts concerning the possibilities in connection with the peat question are the main reasons for the present state of affairs.

Of course, working out the destinies of a great industry like the peat industry requires time. Yet, a few peat mills, rationally constructed on the basis of thorough knowledge and appreciation of local conditions, and economically run, will certainly have a success and give a great impetus to the development of the peat bogs. Apart from general national-economic considerations that render the utilization of peat important—as, for instance, the possibility of a great coal strike—it is just the great variety of applications of which peat is able that can and will make the peat utilization a profitable business. Thus, it would be wiser to recover from peat sulphate of ammonia, wood alcohol and acetic acid now produced from wood and partly from coal and to use the wood, say, for paper mills. Likewise it would be wiser to produce charcoal from peat instead of making charcoal from birch, maple and other good timber—as is the case, for instance, in Michigan—which can be used more advantageously for other industries. In places with lack of fuel the peat beds should be worked for the production of this necessary article. Where fertilizers are needed and expensive the utilization of peat as fertilizing material is self-evident. When we still recall the usefulness of peat as deodorizing, antiseptic and preserving material, as filler for fertilizers and for a number of other purposes, we naturally come to the conclusion that there will be money in the peat bogs which when rationally and properly utilized will create a number of profitable and useful industries in this country.

Dr. Joseph Hyde Pratt, President of the American Peat Society, recently spent a few days in Washington, and consulted with the editorial staff of the Journal relative to some important plans for the future of the Society. He reports considerable interest in regard to the peat deposits of the coastal plain in North Carolina.

PEAT AND SWAMP LANDS.

Joseph Hyde Pratt.

(President's Address, Read at the Toledo Meeting.)

Since the organization of the American Peat Society a year ago, the interest in the utilization of peat has steadily advanced, and although there are as yet but few companies operating peat deposits, yet it is undoubtedly true that those interested in the fuel supply of the United States realize that peat is a fuel that will be utilized more and more in this country, and is a factor to be reckoned with in considering the sources of supply of fuels. The general knowledge of the value of peat as a source of fuel has been rather meager and many companies have been organized for the purpose of developing peat deposits without the promoters having any adequate idea of what was necessary to make the project a success. The result has been that many of these companies have been failures, and those who have invested in them have lost all they put in. These failures and set-backs to the development of peat properties have been due to the fact that the deposits themselves were not thoroughly examined in order to determine the quality and quantity of the peat; cost of extracting it and preparing it for market as compared with the price of fuel in the vicinity. It is absolutely necessary before undertaking the operation of a peat deposit to determine **first**, the quality of the peat, whether it is of such grade that it will make a fuel of commercial value; **second**, the extent of the deposit, whether it is of sufficient area to warrant the establishment of a plant for preparing it for market; **third**, the determination of the cost of digging, drying, and preparing the peat for market, as compared with the selling price.

The value of peat as a fuel is well recognized, and as it burns without soot, with little smoke, and leaves practically no clinkers, it makes a very clean fuel, especially for domestic purposes. It can also be used for metallurgical purposes and for boilers. It is undoubtedly true where peat is used as a fuel under boilers that the boilers will last considerably longer than where coal is the fuel used.

Perhaps the main reason why the peat of the United States has not been utilized is that other forms of fuel have been so abundant and could be produced so cheaply that there has been no apparent necessity for attempting to utilize peat, and, therefore, but little attention has been given to this fuel. With, however, the large demand that has been made upon the coal supplies of this country and the warning that has

been given in regard to their waste and need of conservation, government and state officials have begun to look for other sources of fuel, and peat is claiming their attention.

It seems to me that many peat deposits are so located in close proximity to towns that it would be possible and practicable to erect an electric plant at the bog, using the peat as the fuel, and converting it into electric power, which would be transmitted to the town. The peat could be used as briquettes or in a gas producer.

Considering the enormous areas of swamp lands in the United States, a large proportion of which contain deposits of peat, and as it is an established fact that peat does make a good fuel, we are fully justified, as a society, in urging our congressmen to request Congress to make an adequate appropriation for establishing, in connection with the Technologic Branch of the U. S. Geological Survey, facilities for carrying on extensive experiments in the utilization of peat.

One series of experiments that I especially desire to see carried out is the use of peat in gas producers. To what extent must the peat be dried before using it, and to what extent does its dryness increase its efficiency.

There are over eighty million acres of swamp lands in the United States. Of course, all of this does not contain peat, and of that which does, only a small portion contains deposits of commercial quality. Large areas of these peat swamp lands can, however, be reclaimed and brought into a state of cultivation by means of drainage. These swamp lands have attracted the attention of investors for many years, as their value for agricultural purposes was recognized. One of the draw-backs to the utilization of those swamp areas that were covered with timber was the cost of clearing. Now, however, since the timber itself has become of such value that its removal has been profitable, it has reduced this cost of clearing. Also the advance made in dredges and methods of drainage makes it now possible to drain these large areas of swamp land at a figure commeasurable with the increased value of the land itself. Where the swamp lands are composed of thick beds of peat their agricultural value is not very large, on account of the cost of preparing the land and bringing it into a state of cultivation. This is due to the large amount of water held mechanically by the peat which in time causes a shrinkage or settling of the land; the very large percentage of humus, and lack of other constituents that are necessary to make good crops. There are, however, many of our swamp areas where the percentage of peat is low, but still in sufficient quantity to give the right amount of humus to the land, after it is

drained, and making very rich and productive soils. As an illustration of the value of some of our swamp lands after they have been drained, I would like to state what has actually taken place during the past year at one locality in North Carolina. About five miles southeast of Pinetown, Beaufort county, a canal has been constructed through one of our large swamp areas for a distance of five miles and has a width of 30 feet and depth of 7 feet. Before this canal was begun the people living in the vicinity of the swamp all claimed that it would be impossible to drain the swamp, as there was not sufficient fall to take care of the water. The ones who were interested in the project, however, had had a survey made of the swamp and were confident that there was sufficient fall along the line of the canal to take care of all the water and drain the land. As the canal was being constructed, it was found necessary at the end of a mile and a few yards to construct a retaining dam six feet high in order to keep sufficient water in the canal to float the dredge. After another mile and a quarter of the canal had been constructed, it was found necessary to build another dam six feet high. After the five miles of canal had been constructed, the total fall in that distance was found to be a little over 12 feet. The dredge was then taken back down the canal and the dams removed. During the extreme heavy rains of the past summer in Eastern North Carolina, this canal was able to take care of all the excess of of water, and as far as I could ascertain, it never rose over 12 inches in the canal. Last spring in order to determine the actual agricultural value of the land drained, 10 acres bordering on the canal were cleared by cutting down the trees and underbrush and burning them up, but leaving the stumps. Corn was planted by means of a hand-drill made out of a piece of hollow gum wood. There was no opportunity for plowing the field, so the corn was planted by simply running the drill into the ground and dropping the seed. It was also impossible to cultivate the corn as it was growing, on account of the stumps. The fires, however, had destroyed all of the undergrowth, so that there were no weeds to interfere with the growth of the corn. This tract produced an average of 40 bushels of corn to the acre, and this will give an idea of the great value of this land for agricultural purposes. With the construction of lateral canals this main canal will be capable of draining from 6,000 to 7,000 acres. Another advantage gained by the drainage of these swamp lands is the construction of a system of good roads along the banks of the canals. In connection with the canal just referred to, a road bed has been made along its bank.

There has been a valuable addition to the literature on peat during the past year in the publication of Mr. Chas. A. Davis on Peat Deposits in Michigan, including Essays on its origin, uses and distribution. In this report, Prof. Davis has given most valuable information regarding the practical value of peat deposits, and this can be used to good advantagge by those who contemplate developing peat deposits for commercial purposes. He has shown that there is considerable variation in the quality of peat deposits, due to the form of the land surface upon which they are found and the height of the water above this at the time they were formed; and also upon the species of plants from which the peat has been derived. While this volume of Prof. Davis was prepared especially for the Michigan Geological Survey, yet it is the most comprehensive treatise on peat that has yet been published, both from the view-point of the scientist and the commercial man. It takes up in the minutest detail the formation of peat-bogs, a description of the various plants that have added to the formation of the peat, the many and varied uses of peat, and also gives detailed information of how to avoid making mistakes in determining the value of a peat deposit.

Another report is by Mr. E. Nystrom of the Department of Mines of Canada. In this report Mr. Nystrom devotes but a small amount of space to the occurrence of peat, and it is given up almost entirely to the methods of manufacture of peat in European countries. This volume is, in its field, of as much value to the peat industry as the one of Mr. Davis on the occurrence, uses, and examination of peat deposits.

The Journal of the American Peat Society is doing a good work in spreading reliable information throughout the country on the value of peat for various purposes, and one of the most valuable purposes of the journal will be the dissemination of reliable data regarding the peat industry; and I am looking forward to a large increase in subscriotpions to the journal on account of the number of persons who are becoming each year more interested in the utilization of peat for various purposes. It is gratifying to know that the U. S. Geological Survey is constantly referring inquirers to the American Peat Society for information on this subject.

In regard to the Technological Branch of the U. S. Geological Survey, it seems to me that the American Peat Society should be represented on their Board of Advisors, espepcially as we are interested in the development and utilization of a fuel, and some resolution should be passed by the Society at this meeting and addressed to the Director of the U. S. Geo-

logical Survey requesting that this Society be recognized and asked to appoint one of its members to represent it on the Board of Advisers of the fuel testing plant of the Geological Survey.

ARTIFICIAL WOOD MADE FROM PEAT—A NEW AND VALUABLE BUILDING MATERIAL.

Freidrich Schuenemann, St. Louis, Mo.

(Read at the Toledo Meeting.)

A recent important invention, which makes it possible to realize on a large scale the waste moors until now nearly useless, was a great attraction in the German exhibits in the Agricultural Building at the World's Fair in St. Louis, also a part of the exhibits of peat products. The most interesting exhibit being that of 36 specimens of artificial wood of different colors and patterns, made out of peat and exhibited by Architect P. Hemmerling, from Dresden, Germany, who is the inventor of the method patented under the name of Emil Helbing, from Wandsbeck, near Hamburg.

The writer of this essay is holder of the United States patent. Most of the former experiments to make artificial wood out of peat have proven to be unsatisfactory, the old methods requiring the material to be completely torn up into a stringy and pulverized substance. These were mixed with gypsum (2 volumes) and water (10-12 volumes); then it was necessary to subject the mixture to a high hydraulic pressure, dry it and after this oil and paint it.

As compared with the above, the Helbing-method German patent 128728, shows an important simplification.

The wet peat—in general a dark Eriophorum-Sphagnum peat is washed without changing the natural fiber, after which the peat is mixed with hydrate of lime (water-slaked lime) and with albuminium combination, and, perhaps, sulphurous-argillaceous earth, the entire mixture being pressed in moulds with a pressure of 6,400 to 7,100 pounds to the square foot, the excess of water being released by the pressure. After a short application of the pressure the board can be taken out of the mould, when it is already very strong and needs only to be completely dried in the open air and worked to the necessary dimensions to be ready for use. The boards produced by this methods can be worked as easily as natural wood, although their strength is much superior to the strength of the natural wood. They can be polished and painted and according to the statement of the inventor, are 30 to 50 per cent. cheaper than

articles made out of good oak wood. By reason of the simplicity of this method it is no longer necessary to have a large stock of raw material, thereby avoiding the investment of a large part of a company's capital in materials for carrying on a business.

The artificial peat wood is suitable for: (1) flooring of every kind; (2) doors, fire-proof stairs, ceilings, panels and all other cabinet work; (3) sidewalks and roof coverings; (4) railroad ties; (5) pavements for streets and, factories; (6) ornaments of every kind, especially for furniture, ceiling decorations and mechanical art products; (7) complete furniture from the simplest to the most elegant design; (8) ship building and street car building; (9) for railroad ties and for pavements, the impregnation, so expensive but necessary until now, can be avoided by using peat wood.

The hardness and the great strength of the artificial wood are at least equal to those of the best natural wood; it is not hygroscopic and does not require painting or impregnation for use in the open air. The new peat-wood is of great value not only by reason of its strength, but is also fungus-proof and very little affected by heat.

With reference to the tests made by the Royal Institution of Experiment at Dresden, the peat-wood belongs to the slow-burning materials, and thereby especially suited for fire-proof buildings. The following prominent men, known as authorities on moor-culture, showed great interest in the new peat-wood:

Prof. DuBaumann, director of the Moor experiment station at Munich; Dr. Bersch, director of the Moor experiment station at Vienna; Zablowski, secretary general of Moor Society for the German Empire, who visited the demonstrating plant, were present while the artificial wood was produced and gave the opinion that the new product would be very useful for all purposes, which indicates for it a splendid future. At a session of the Central Moor-Commission for the German Empire, 1903, several samples of the peat-wood were presented by the first Counsellor of the Government, Prof. Dr. Fleischer. All these samples were given the unanimous approval by the members of the Board.

At the exposition of the German cities at Dresden, 1903, the peat-wood was awarded a deed of honor by the Board of Awards, the members of which were the best known experts. At the World's Fair in St. Louis the inventor of this method was awarded the gold medal.

The royal mechanical-technical-experiment establishment to the technical academy at Dresden examined and tested the

peat-wood, with regard to tension, compressing strength, water absorption, wear and tear, and resistance against heat.

The results of these tests are as follows:

I. Compressing Strength.

Of artificial peat-wood, 603 to 738 kg. sq, cm., or 8,575 to 10,495 lbs. sq. inch.

Fir wood ..... 710 lbs. sq. in.
Pine .... 855 lbs. sq. in.
Oak and beech . 1,140 lbs. sq. in.

The latter two rates are given by the Berlin Building Board and by the Building Department of the Prussian Ministry for Public Works.

II. Resistance Against Heat.

The artificial wood does not burn, but only glows where held over a flame, and this even when the heat is very great. Those parts which are not reached by the flames remain uninjured. Therefore it is absolutely impossible for the fire to spread over the peat-wood. After the flames are extinguished the peat-wood immediately ceases to

With regard to the natural wood, the fact is well known that it burns with large flames, thus producing a great heat; and that the fire spreads very rapidly over it.

The artificial wood does not crack nor warp either from the influence of fire or water.

III. Wear and Tear.

As a result of tests, peat-wood has a wear and tear of 10.11 cu. cm., or 0.617 cu. inch.

For hardest pine wood, 19.09 cu. cm.=1.165 cu. inch., and for oak wood, 11.39 cu. cm.= 0.695 cu. inch.

IV. Hygroscopicity.

The ascertained quantity of water absorbed by

the peat-wood after it was dipped for 144 hours into water was 12.57 per cent. original weight.

oak wood is in general up to 24 per cent. water, while more porous wood absorbs up to 30 per cent. of the original weight.

The changes of the original length

of peat-wood after dipping it into the water for 144 hours was 1 per cent.

are in general for natural wood up to 5 per cent. and even more.

The ascertained shrinkage of the original length

of the peat-wood after drying it in the vacuum apparatus for 48 hours was 0.617 per cent.

of oak wood is about 3.9 per cent.

V. Tension.

The tension of peat-wood is 73 kg. sq. cm. or 1,040 lbs. sq. inch.

Fir has only 60 kg. sq. cm. or 853 lbs. sq. inch.

Considering the great importance of the above described invention, especially regarding the national economy and to avoid discouraging experiences and needless expenses, which are in general connected with the realization of most of the patents, the owner of the patent has erected at Dresden a demonstration plant, at his own expense, open for inspection by the public. The plant is equipped with a hydraulic press of 1,100,000 lbs., and for the last three years has made all trials for the regular work, directed by an approved expert.

By this means all technical difficulties have been overcome and the excellent results now in question have been obtained, which attracted the greatest attention and gained the most liberal approval of all professional men.

Last Fall the above results were sufficiently encouraging to extend the experiments on a large scale by using peat-wood for paving a street at Dresden, which has a very heavy traffic. This trial showed good results in spite of the frequent and sudden changes of the temperature which occurred last Winter in Germany. Not the least change in the paving material was seen from the effects of rain, frost, snow, thaw or sunshine. Aside from this the street was traveled by carriages loaded with 4 to 5 tons (8,960 to 11,200 lbs.), and until March it did not show the least wear or tear. This pavement has proven to be much better than asphalt, and it lessens the noise of the carriage traffic equal to asphalt pavement.

For a long time all European governments have been anxious to utilize their large, and until now, nearly worthless peat bogs, and for this reason it is expected that the government will support every attempt to introduce the new building material, especially for flooring, street pavement, railroad ties, etc., as the difference in price is in favor of the peat-wood.

For instance, the cost in Germany of:

1,000 sq. ft. flooring of oak wood	Marks	465.00
1,000 sq. ft. one colored inlaid floor, peat-wood....	"	237.50
1,000 sq. ft. 2 or 3 color inlaid floor, peat-wood....	"	563.50
1,000 sq. ft. common inlaid floor, oak wood........	"	961.50

This great difference in cost seems to be sufficient in itself to expect the best for this ingenious invention.

The United States has in many of the States thousands of acres of peat lands, now unused, while the beautiful hard-wood forests, once a pride of the country, are ruined for a term of many years and there is already a scarcity of lumber for railroad ties and for building timbers.

I hope this essay will help to direct the public attention to this important invention and to advance the productions of the peat-wood to a large industry since it is a fact, which should not be under-estimated, that if iron and peat-wood are used for buildings and for their interior work, the heavy damages now done by fire will be greatly reduced.

Concerning another part of the peat industry—the production of peat-litter and peat-mull (powder)—which flourishes in Europe and bids fair to be an important part of the agriculture, I will send you later a detailed report.

Below is given a translation of the report on the tests described above:

TEST CERTIFICATE OF THE ROYAL MECHANICAL-TECHNICAL-EXPERIMENT ESTABLISHMENT OF THE TECHNICAL ACADEMY AT DRESDEN.

Mr. Emil Helbing, from Wandsbeck, near Hamburg, Germany, on Sept. 28th, 1903, through his solicitor, Mr. Paul Hemmerling, delivered the testing certificates 03/121, 03/176, 03/179 and 03/182, concerning tests of artificial peat-wood, of the Royal Mechanical-Technical Experiment Establishment, and requested the writing of a combined certificate, covering all the testing results of the plates 103, 121, 357, 394, 395, 399 and 402, which have been subjected to the tests.

I. Crushing Strength.

Certificate 03/121 from March 9th, '03. (Plates 103 and 121). Dimensions of the plates about 25 x 25 x 1 c. m. (10 x 10 x ⅜ in.)

(a) Trials with Cubical Pieces.

To undertake these trials, from each plate cubical pieces have been made, the edges of these cubes being equal to the thickness of the plates, the surface being ground even with emery.

The pressure was applied perpendicular to that part of the surface which was originally a part of the surface of the plate.

No. of the Plate	No. of the Test Piece	Area sq.cm.	(sq. in.)	Crushing kg.	(lbs.)	Strength Av. kg.sq.cm.	(lbs.) sq.in.
	1	1.35	(0.21)	600	(1320)		
103	2	1.37	(0.21)	540	(1188)		
	3	1.32	(0.20)	645	(1419)	442	(6285)
	1	1.76	(0.27)	565	(1243)		
121	2	1.78	(0.28)	580	(1276)	324	(4607)
	3	1.64	(0.25)	531	(1260)		

(h) Trials with Plate-Shaped Piece.

From each of the delivered plates of artificial peat-wood square plate-shaped pieces were made, the sides of the squares equal to the threefold thickness of the plates for one line of tests, those for the other line measuring 2 inches.

The pressure was applied perpendicular to that part of the surface which was originally a part of the surface of the plate.

The following table shows the results of these tests:

	Test-pieces are square plates the length of the side being equal to the threefold thickness.			Length of the sides of testing pieces 2-in.		
No. of the plate.	Area.	Crushing Strength kg. (lbs.)	kg.sq.cm. lbs. (sq.in.)	Area.	Crushing Strength kg. (lbs.)	kg.sq.cm. lbs. (sq.in.)
103	10.2 sq.cm. (1.58 sq.in.)	6830 (15026)	670 (9528)	23.79 sq.cm. (368 sq.in.)	17500 (38500)	738 (10495)
121	14.4 sq.cm. (2.23 sq.in.)	6770 (14894)	470 (66834)	23.2 sq.cm. (3.6 sq.in.)	14000 (30800)	603 (8575)

II. Resistance Against Heat.

To ascertain the resistance against heat, pieces of the delivered material (broken parts from the tensile-strength tests), were placed on a suitable frame and heated by means of Bunsen-burners, set below the peat-wood.

With this, the material directly touched by the flame glowed without development of a flame. The glowing did not spread beyond the places reached by the flames and disappeared as soon as the burner was taken away.

III. Wear and Tear.

(Certificates 03/176 of Sept. 18th, '03, and 03/182 of Sept. 24th, '03). Plates No. 357, 394 and 402.

Two square pieces were cut out of each plate and in pairs subjected to a wear and tear test on Bauchinger grinding machine.

The surface of the square of each piece made out of plate 357 measured 25 sq. cm. (3.86 sq. in.); the pressure applied to each of the two pieces was 15 kg. (33 lbs.) and 11 g. (about 3/8

of an oz.) of emery were used for every 22 revolutions of the disc.

The square of the pieces cut out of plates 394 and 402 had an area of 50 sq. cm. (7.72 sq. in.); the pressure applied on each was 30 kg. (66 lbs.), and 22 g. (about ¾ oz.) of emery were used on every 22 revolutions of the disc.

The average grinding radius was 22 cm. (8 11/16 in.), the speed being 0.69 meter per second (136 ft. per min.)

The grinding material used was Naxos emery No. 3. Before the emery again was applied the disc was cleaned from the rest of the old grinding material and the dust of the testing material. Every test was made 5 times with always 22 revolutions of the disc and every time the wear and tear was ascertained by weighing the testing pieces.

Before doing a new test the surface was ground even, holding the piece with the hand and applying only a low pressure. The figures given in the table below are averages, gained from two testing pieces made out of the same plate, and reduced, according to the usual conditions, these are:

440 revolutions of the disc; 50 sq. cm. (7.72 sq. in.) grinding surface; 30 kg. (66 lbs.) pressure applied; 0.69 meter per second (136 ft. per min.) speed; 22 g. (about ¾ of an oz.) Naxos emery No. 3 for every 22 revolutions of the disc.

No. of the Plate	Specific Gravity of the Plates	Wear and Tear Reduced on 440 Revolutions of the disc and 50 sq. cm. (7.72 sq. in.) Grinding Surface,			
		By weight, gr's.	(ounces)	By Vol. cu.cm.	(cu.in.)
357	1.222	21.52 g.	(0.76 oz.)	17.61	(1.07)
394	1.358	21.16 g.	(0.75 oz.)	16.34	(1.00)
402	1.435	26.60 g.	(0.94 oz.)	18.54	(1.13)

IV. Hygroscopicity.

(Certificate 03/179 of September 19th, '03.) Plate No. 395 and 399.

To ascertain the capability of the peat wood to absorb water, two bar-shaped pieces of square cross-sections were cut out of every plate, none of these pieces having a part of the border of a plate as a part of its own surface.

After the testing pieces had been weighed and measured, they were put into water of moderate temperature for 144 hours. The increase in weight and the changes of the length

are shown on the next table in per cent. of the original weights and lengths (i. e. of the state when delivered):

No. of Plates: Cars:		395 I	395 II	399 1	399 II
Original Length:	mm.	289.42	289.28	270.78	270.55
	inch	11 101/256	11 25/64	10 169/256	10 167/256
Increase of the length in % after wood was dipt into water for hours:	24	0.681	0.695	0.770	0.931
	48	1.030	1.051	0.880	1.064
	96	1.400	1.493	0.984	1.157
	144	1.594	1.765	1.000	1.216
Original Weight:	grammes	141.80	141.69	202.93	214.83
	oz.	5.00	4.99	7.15	7.55
Inc. of original weight in % after peat wood was dipt into water for hours:	24	8.13	9.45	10.34	12.70
	48	10.77	12.16	11.86	13.28
	96	13.84	15.50	12.32	13.74
	144	16.40	17.93	12.57	14.02

To find the amount of moisture contained in the testing-pieces in the state of delivery, the pieces were dried in a vaccuum apparatus for 48 hours at a temperature of 100 centigrade (212° F.). After this the pieces were weighed and measured. The decrease of weight and length and also weight and length in the state of delivery considered, both the amount of moisture in the state of delivery and the shrinkage, if completely dried, were found out.

	395 I.	395 II.	399 I.	399 II.
Shrinkage in % of the original length after 48 hours' drying in the vacuum apparatus.	3,238	2,904	0,691	0,617
Amount of moisture at state of delivery in % of the weight at state of delivery.	15.88	15.98	8.97	8.62

Dresden, September 29th, '03.

Royal Mechanical Technical Experiment Establishment to the Technical Academy at Dresden.

THE DIRECTOR.

(Seal) Signed: T. A. Wawreinick, Assistant.

(To be continued.)

The Farmers Farm Company of Plymouth, Ohio, has purchased from the Commercial Artificial Fuel Company a modified form of their peat mill No. 3, which has been specially designed to furnish peat uniformly ground for drying in a cylindrical dryer. The product to be made is peat fertilizer filler, and the company is reported to have more than $50,000 invested in land and plant near Plymouth, and an output of 50 tons a day is anticipated.

A NEW GAS PRODUCER FOR PEAT.

Dr. Otto K. Zwingenberger, New York.

(Read at the Toledo Meeting.)

That the difficulties in developing the use of peat as fuel mainly consist in the drying of the raw material, its bulkiness, and the resulting difficulties in transporting can't be denied, if it comes to the drying of peat after the old style for producing the air-dried stuff for household purposes, or for coking or for producing gas in generators. Both enthusiasts and pessimists on this point are generally going too far in their statements, but to anybody who can keep cool in considering the matter, it will be evident that for producing the raw material for running gas producers with peat the difficulties are certainly the least invincible.

What are the objections and claims against peat for this use and by whom are they made? It was in the recent days that somebody pretty bluntly made the statement that the use of peat in this country would be positively prohibited, for the reason that nearly all American peat-bogs were so flat and directly on the level with the water that no one would be able to get out a reasonable amount of raw material in face of the difficulties with labor in general, and especially in view of the high wages; furthermore, it was said that the cost of bituminous coal is still very low, that there is no machinery giving facilities in excavating and transporting such sluggish raw material, and that there is no serious business man who, after a careful study, would entertain the idea of making peat the basis of any industrial plant, not even for gas producer work.

Anybody has a right to express his opinion, even if it seems to be entirely unfavorable and denies nearly any chance of success to the men who devote their time to solve a question so important to the country and a great number of its inhabitants. Generally such pessimistic opinions are maintained by people having experiences of their own, and it is to us to respect such criticisms, as they are the real incentives which render other people keen enough so that finally one day the problem is "really" solved, as ungrateful mankind will not yet recognize the several fellows who have already "really" solved it and who perform with their machine, in the easiest way, what all the scientists together were unable to do. The days of the "Jims" and "Tims" going into the peat business for some yellow real estate boom will probably soon have passed, as the people are now really warned enough, and the experiences of serious people are only a step more in progress, provided we

really learn about their methods, applied in work, and the troubles resulting therefrom.

In the history of technical chemistry we have several excellent examples of endurance by which we see that work of apparently the greatest simplicity met with the greatest hardships and brought several excellent men pretty near despondence. The foremost example in that line is the Solvay Soda Process. This process, based on the action of sodium chloride on ammonium bicarbonate in waterous solution, was known since 1838 by the studies of the two English chemists, Dyar and Heming; they founded a factory and failed. In 1840 the famous chemist Muspratt invested a large amount of money and, after two years, closed up his factory too. Later on there were several people of the highest technical and of good financial standing working at the same time to make the process a success, as Gossage and Deacon in England, Kunheim in Germany, Rolland in France; each failed in his efforts and finally the process was declared unexecutable on a large scale.

In 1863 Solvay took up experiments in this line; by a most careful study and experiments on a large scale he exhausted in a more than seven years' time his considerable fortune, confessing later on that by the strain of overwork and excitement he was on the verge of suicide, when, with the investment of his last money, he finally succeeded. And even then, with the introduction of this process at other places, there were sometimes difficulties enough to make the people doubtful, until by a staff of able collaborators it became one of the greatest successes. The history of this process is one of the most glorious examples of happy outcome, and, the situation at its start is most strikingly similar to our peat proposition. We all intend to achieve that one success and from the fact that history repeats herself, also in cases like ours, we are induced to stick to the matter to the benefit of the whole.

In considering what kind of raw material from peat we need for the gas producer, we come to the conclusions: (1) that it does not need to be brought into a special form; that loose crumbles of moderate size will do; and (2) that the peat may still have a higher amount of water than would be good for coking or household fuel. As to the form of peat for gas-producer, it is proved by European practice that loose peat and the refuse of peat from the bogs can be easily burned up in the producer; that the size of the peat crumbles may be pretty small, though just this point depends much on the hardness of the stuff and great variations may take place as to that. This European practice is supported by the successful work in about

the same way at Orlando, Fla. It involves several facilities which may be pointed out here.

A small peat-bog of about 50 to 70 acres will supply a moderate power plant for a good many years, and one may assume that an owner of such property, intending to use the peat for power, has some acres of land around the bog where, in case the bog is submerged, he can forward the excavated peat to dry it on solid ground. On a few acres of land of course one could not dry peat extensively on a large scale for general use, but for gas-producer work it is not so hard, if we go to the bottom of the matter. Let us remember that any wet peat, pulped in a machine, loses its water down to about 60% in a few days, and that it can then be handled, when formed in bricks. This behavior of peat has always occurred to me to be of great importance; and, though I can't support my suggestion, I would like to attach to this very point by practical work; for on my going into another business I would like to be permitted to outline my ideas, which I know from my experience in chemical engineering, can be easily put into working shape and which may open the way to one of my fellow-workers in peat.

As raw peat loses its water down to 60% readily in some few days, a drying ground can be covered again in every turn of a few days with fresh peat and the lumps and crumbles could be stacked up in big heaps to be stored for gas-producer work. Somebody may ask, How about the wet peat in winter time? As to that, we have to say that the cold can't do much harm to such peat, for even if the upper layer is frozen hard the cold could not penetrate the whole mass so easily. Besides that one could protect the wet peat by laying on some layers of moss, etc. Peat subjected to cold presents itself later on as a spongy matter without any firmness, but that doesn't matter so much as the peat still carries the heating value and may be burned up in the producer, just the same. So we may put aside a great deal of work and care for the raw material for the gas-producer, thus decreasing the cost of production, whereas we could not omit to observe this care for coking material and household fuel. Now, wet peat with 45-50% of water, can be burned up successfully in a gas-producer, but it is a matter of course that an air-dried material of about 25% is certainly much more desirable if the producer process is to go on smoothly and turn out a rich gas. Is there any way to dry the wet peat of about 60% water down to a lower amount without much cost? I think there is. The observation of our Dr. McWilliams, on which he based his new process of collecting peat and which I found stated in some other way last

year, gives some guarantee that we may dry some quantities of peat in a similar way by the "off heat" of the gases coming from the producer, which up to now is partly used for preheating the water for the generation of steam and air, but in many cases is directly wasted. Here I would like to make a suggestion which seems to me to be worthy of some consideration:

We have the off-going gases passing a condenser and a scrubber to enter the gas engine at a low temperature. In my mind there is no doubt that the heat of those off-going gases can be successfully used for drying loose crumbles of wet peat sufficiently to guarantee a smooth running of the producer and the generation of a rich gas. How to carry out that idea? In thinking over that problem I always remembered the Gerstenhoefer furnace, which is used in the manufacture of sulphuric acid for roasting fine, dusty pyrites; that is, the process of burning off the sulphur of such pyrites under access of air and which requires constant moving of the raw material. This furnace was one of the first achievements to solve this difficult problem of roasting dusty pyrites, and though there are better mechanical constructions today, old furnaces of this type are still in operation even now. The peculiar feature of this furnace consists in triangular prisms arranged in the way that each lower one is placed in suitable distance in the space between two upper ones. So on each prism a certain quantity of any material, in our case small pieces of peat, will accumulate if fed at the top through the hopper, and it goes without saying that any new charge of material will push the preceding one down to the lower prisms, thus the material turning itself without any human work or machinery. Now, let in our case those prisms be of iron, and made hollow and the hot producer gases go through them, entering the triangular system at the bottom, they will heat the air entering the chamber around the same at the bottom. You will readily see that the peat will meet hotter air the lower it arrives, and if the crumbles have a medium diameter there is no doubt that the peat will be reduced a good deal in water content and that the more the higher such a drying furnace would be built. Whether the hollow prisms are substituted by flat iron tubes will make no difference. (Plate I.)

The ignition of the peat on the lower and hottest prisms will be avoided by the cooling of the air and certainly by putting a sheet iron on those respective prisms, leaving some space (as seen in fig. 2) that the air may freely pass through.

Now for the conclusion, let us consider that the wet crumbles are fed to this drying apparatus, which one may call a

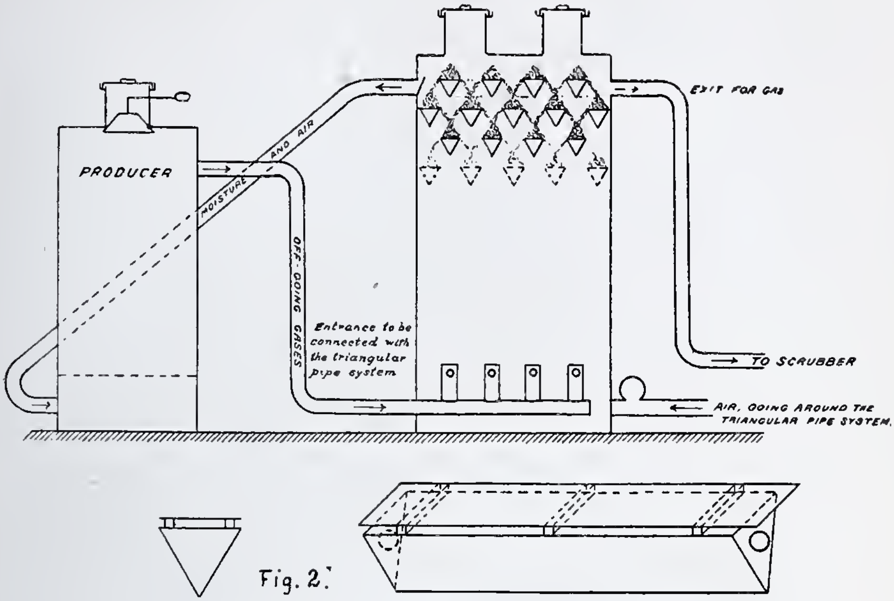

Plate I. Gas-producer and Drying-tower for using Peat.
Fig. 2. Details of triangular tubes.

drying tower, through the hopper at the top and fall by their own weight to the ground again. Just the same way the dry peat is fed to the producer. As any producer is generally provided with a little bucket elevator, both the drying tower and the gas-producer could be supplied with the material if the elevator is erected between the two, and the material is directed by chutes. If on top of each apparatus a storage bin is provided, the running of the elvator can be limited to relatively short times.

The whole scheme allows the killing of two flies with one stroke. As any gas-producer needs, for well-known reasons, a pretty good supply of steam, the manufacturers combine generally blowing in the steam with drawing in the air by an injector. If in our case the drying tower is closed and the air, which will be highly saturated with water vapors, is allowed to escape through a pipe, it could be directed to the producer, and there is no doubt that this air carries a good deal of the water necessary in the producer. As water in peat of 50% lowers the temperature in the producer and tends to increase the carbonic acid in the gas, we certainly can, by the way I have suggested here, make the best use of water which is now such a serious burden.

INDIANA PEAT, ITS ORIGIN AND VALUE.

Arthur E. Taylor, Findlay, Ohio.
(Read at the Toledo Meeting.)

During the spring, summer and fall of the year 1906 I visited all of the large peat beds in the State of Indiana for the purpose of gaining reliable information as to their location, extent and value, and to point out certain physical and topographical phenomena that would be of interest to those who enjoy the study of nature. These deposits, which taken together, will cover about 200,000 acres, or 312 square miles, occur in the three northern tiers of counties.

Small beds of peat are found to some extent in all the area covered by the late Wisconsin drift, which has its terminal moraines in the central part of the State, but the substance occurs in workable quantities only in the three tiers of counties. The peat beds appear in the sites of old glacial lake basins, in lake basins that have been developed between sand dunds and in "bayous" or "ox-bow" lake basins, which have been left in the flood plains of meandering streams. The first topographical position is most prominent in the northern and northeastern part of the peat region; the second is very noticeable in the northwestern corner of the State; and the third is found especially in the Kankakee and Little Calumet River Valleys.

The larger and most important of these peat deposits are those which occupy the sites of old glacial lakes. Almost all of the moss peat of Indiana and 70 per cent of the grass and sedge variety have this topographical position. Since all of the workable deposits of the State are limited to the counties found in the lake region, and most of the beds have had their development in these lakes, a brief history of the lakes and their origin will be helpful in understanding the forming of the peat deposits.

These lakes and the topographical features surrounding them are the monuments of the last continental ice sheet. They belong to the very latest moraines of the glacial period. Their origin took place when the great ice lobes began their recession, dropping their heterogeneous loads of clay, sand, gravel and boulders in irregular masses, which gave rise to a hummocky topography, without any drainage. Consequently almost an innumerable number of depressions, technically called "kettle basins," were present, which became occupied by lakes or ponds wherever the bottoms were below the ground-water level. Today only a small percentage of these lakes and ponds are left, many having been destroyed by the development of a natural

drainage; others through the carrying in of debris or foreign matter by streams and springs, or the lowering of the ground-water level by the cutting away of the timber, dredging and tiling; and last and of particular interest to us, the filling up brought about by the partial decaying and acccumulation of vegetation.

The filling of these lakes by vegitation undoubtedly began as soon as the ice receded, and is today going on in some degree. Water loving plants such as sphagnum and other mosses, grasses and sedges found, and today are finding, their way out upon the surface of the water. This covering gradually thickens, and the decayed peaty matter falls off from the lower side of the raft and accumulates on the bottom of the lake. At first this moss covering is very thin and will sustain little weight, but as it becomes heavier and advances over the surface of the lake, a man can walk out for a short distance on its quaking surface. If the growth and accumulation continues for a sufficient period, the lake may become entirely filled with this peaty substance. The resulting deposit will be termed a peat bed, providing sufficient decomposition underneath the water has ensued. However, if the material is yet in a very fibrous condition and not enough decomposed for peat, a "peat-moss litter" bed would be a more applicable term.

There are two kinds of peat found in Indiana, that derived mainly from the grasses and sedges and that from the sphagnum mosses. The latter class has the higher fuel values, as was learned through fuel determinations made by Dr. R. E. Lyons of the State University of Indiana.

These sphagnum moss peats occur mainly in the eastern half of the peat area, and are generally situated in tamarack swamps. Some of these deposits cover several square miles and were found, by my own sounding, to have in places depths of 30 feet; and were reputed by well drillers to be as much as 80 feet in depth. It was often very difficult to sound these beds on account of the buried tamarack logs. In portions of the marshes where the ground was quite moist, the mosses frequently took the appearance of a great carpet covering several acres.

Ninety per cent of the peat derived solely from mosses comes from the species known as Sphagnum cymbifolium. Always associated with this form is the moss which holds the next place of importance as a source of the moss peat, namely, Sphagnum acuminatum. In addition to these two sources, the mosses Climacium americanum, Cylindrothecium seductrix, Dicranum scoparium, other mosses, various species of ferns and

a few other plants play a small part as sources of origin for the real moss peat of Indiana.

The grass and sedge variety is found in greatest abundance in the north central part of the State and a little west of the north central part. The Kankakee River marsh, in the vicinity of South Bend, is likely the largest continuous deposit, having a length of 11 miles and a width of 1½ miles. The derivation of these beds seemed to me to be principally from the grasses and sedges and in a less degree from reeds, rushes, ferns, mosses and other forms of vegetation. This conclusion was arrived at from the phenomena noted upon visiting lakes surrounded by the peat beds. Many such lakes I found with cat-tails (Typha) and arrow heads (sagittaria). The partially decomposed vegetation associated with these was of no practicable use as a fuel, being merely a loose mass of fibers floating in the water. It was not until a sufficient vegetal covering blanketed the water surface, and the grasses and sedges began to grow, that the bed even commenced to become sufficiently compact and decomposed to be considered a peat bed, and by far the major part of the accumulation occurred subsequent to the beginning of the growth of the grasses and sedges upon the surface. After the grasses and sedges once get well started in their growth, the entire amount of other vegetation soon becomes small in comparison.

The manner in which I carried on my field work for the State of Indiana might be described as follows: Upon visiting a new deposit I would first attempt to get some idea as to the extent and about where in the bed would be the best place to make soundings and procure samples, so as to obtain a definite idea as to the average depth and quality. Since many of the best peat beds were covered with tamarack and heavy heaths, it was often necessary to climb one of the tallest trees to obtain this preliminary information. Before the descending I would get my bearings by means of a compass, my sectional location from a county map, and then draw an outline map of the marsh, putting in the boundaries, high ground and points where soundings would be made. After descending from the tree the points where the various soundings were to be made were visited, observing meanwhile the changes in vegetation, since this helps one greatly in determining the quality of the material, and the thickness of the bed. Upon arriving at one of these points, the sounding auger, which is a common 1¼-inch wood auger welded to a joint of gas pipe, was pushed down in the peat bed to a depth of two or two and one-half feet. Then, by turning the auger, the material that would get into it when it was forced through the surface would be

turned out and the material at the depth of two and one-half feet turned in. The auger was then withdrawn and the material examined, notice being taken as to whether it came from above or below the water-level, the coarseness of the fibers, the color, the origin and stage of decomposition. The sounding auger would again be thrust down, treated in a similar manner and like characteristics noted. Soundings would be continued until the thickness of the bed and the quality at several different levels would be ascertained.

After all of the points mapped out for sounding had been visited, and any others that might seem advisable, another viewpoint was hunted and a revised map drawn. Notes were taken as to the extent, thickness, color, stripping, amount of material above the ground water level, the derivation, the underlying formation, the topographical position, the quality of the material, the possibilities of drainage, the distance from a railroad switch, the condition of the wagon roads and the need of a fuel in the vicinity, the possible demand, whether the deposit would justify the erection of a peat plant, and any other points of interest that might arise. Every peat bed has its individual characteristics in which it differs from all others.

After completing my visits to all of the peat beds I wrote a full account of my observations for each particular deposit, giving its location by county, both congressional and civil townships, section, and quarter section. At the beginning of each county report there is a county map, with all of the main deposits given, and whether they are workable and are of a moss or grass and sedge variety. For especially good deposits, with considerable extent, a separate map was made, showing the sectional location of the bed on a considerable larger scale than in the county map. In such maps I gave the results of my soundings.

(To be continued.)

An unconfirmed report has been received that the International Fuel & Power Company of Ogdensburg, N. Y., will build two barges equipped like the one which was destroyed by fire last October and which was nearly a total loss.

The Daily Consular Report, issued by the Bureau of Manufacturers, U. S. Department of Commerce and Labor, for March 24th, states that a Norwegian importing house wishes the address of manufacturers in the United States who make machinery for digging and pressing ("machining") peat!

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EDITORIAL NOTES.

With this number, the Journal of the American Peat Society begins its second year of existence, with much brighter prospects than it had a year ago. Not only has it received the financial support necessary for it to continue its modest career, but, through the kindness of its friends, it has been given what is even more necessary for the life of a journal, articles relating to its special field, most of which have appeared for the first time in its pages. The present issue has an increased number of pages, as will doubtless be noticed. And it is hoped that this can be continued throughout the next year. It certainly can be done if each member of the Society does what a few are doing—losing no opportunity to secure new subscribers, and to send news items and other matter of interest to the editor for publication.

That this Journal is finding its place is shown by several cordial letters sent to the Editor, and by the increased support it is receiving.

This is the season of the year when actual work should be started. The warm, windy days of April and May are by far the best days of the entire season for air-drying peat, and even in March unless the nights are too cold, drying goes on at a much faster rate than it does in the hotter, more humid weather of July and August. If work is not started until May or June, those peat fuel plants which depend upon the drying effects of wind and sun are losing some of the best weeks of drying weather in the whole year. It must be remembered that the rate of drying does not depend upon the temperature of the air so much as upon its relative humidity, that is, the proportion of watery vapor which it contains, to the amount necessary to saturate it at a given temperature. During April the average relative humidity is reported to be the lowest of any time during the year, hence drying goes on rapidly.

The formation of a strong New England section of the Society at Boston, Mass., and the appointment of a committee to plan for the Third Annual Meeting in that city, insures the success of the meeting, if the members continue to do their part as well as heretofore. An exhibit of peat products should be one of the matters in which all can help, and this ought to be supplemented by a showing of machinery and plans of plants. If the plans are made early enough, every one can contribute something to make this phase of the meeting a very valuable one.

The reports of the two special section meetings, which are given in this number, are of especial interest, as they are but forerunners of what is to be done elsewhere, as the interest in peat utilization grows.

The great interest and activity shown by the people who have formed the two new Sections, and are planning a third, is worthy of emulation by the active members of the Society in other States. What is the reason we cannot have Sections in Michigan, Indiana, Wisconsin, in some of the other States, and in Canada? The constitution provides that when twenty people desire to form a Section, they may do so, and be admitted to the American Peat Society on meeting its requirements for membership.

Since writing the above word has been received that a meeting is likely to be called in the near future to fully organize the Great Lakes Section.

The next meeting of the New York section will be held at the hall of the Chamber of Commerce, Syracuse, in May. For particulars write F. R. Stevens, N. Y. Agricultural Experiment Station, Geneva, N. Y., or Dr. Charles F. McKenna, 50 Church street, New York, N. Y.

The German Peat Society's Annual Meeting took place at Berlin on February 23 and 24, 1909. Outside of the report of the secretary there were seven papers dealing on the amelioration of peat bogs for agriculture. One paper each was on the colonizing of habitual culprits on the Prussian bog lands for which ten million dollars was asked from the government, the latest developments in producing peat litter, but perhaps the most interesting to our readers was on the "Production of Ammonia by the Moist Oxidation of Peat," by the London chemist, Woltereck. His process is already patented in most European countries and America. It claims to overcome the difficulty of eliminating the 90% of water contained in peat. As it is a comparatively easy matter to reduce the existing moisture to 70% in his process, peat containing between 65% and 75% of water may be successfully employed. Just as moist combustion is the dominating feature of the Woltereck process, so is the furnace in which the combustion is effected the dominant feature of the moist combustion process. Mr. Woltereck claims a minimum yield of five per cent of sulphate of ammonia from the peat, calculated as theoretically dry. These German meetings always bear an international character, representatives of Great Britain, Russia, Austria, Sweden, Norway, Denmark and the Netherlands being generally present. They often present papers on the peat development of their respective country or take part in the discussion. It would be advisable for the American Peat Society to send a representative next year, and extend invitations to the European societies for our Boston meeting in September, 1909. The German Peat Society has now 1,009 paying members. Their income is $7,200, of which the government contributes $5,000.

NEW YORK SECTION.

The call for organizing a New York Section of the American Peat Society was responded to by about 50 persons from different parts of the States of New York, New Jersey and Connecticut, who met at the Chemists' Club, New York City, on the evening of Feb. 13th, at half-past seven.

In the absence of Vice-President Stevens, Mr. Herbert Philipp took the chair, and Mr. Bordollo acted as secretary. The chairman welcomed those who were present, stating that such a large audience means that the peat question is quite

alive. He then read a paper by the Vice-President, Mr. F. R. Stevens, in which he principally dwelt upon the agricultural advantages for the State of New York in developing its 2000 square miles of swamp lands.

The principal paper of the evening was by Prof. Charles A. Davis, who has charge of the peat investigations of the U. S. Geological Survey. He gave an estimate of the value of the peat deposits in this country, and the figures go up in the billions and trillions, which made the audience dizzy in following them up. The paper will be published in full in the Journal of the Americal Peat Society.

The next paper was on some gas power propositions by Mr. Robert Ranson, Vice-President for the Southern States, which was followed by some highly interesting remarks on practical results of a gas producer by Dr. Otto Zwingenberger. The chairman, Mr. Herbert Philipp, then read a paper on power from peat, which was listened to by the audiencec with great interest.

Prof. R. H. Fernald, of the Case School of Applied Science and chief of the Gas Producer Division of the U. S. Geological Survey Testing Plant at Pittsburg, reported a number of highly important facts regarding the handling of gas producers. He found that manufacturers, as well as owners of gas producer plants, did not seem to consider that a well-trained engineer was of the highest importance in cheaply and efficiently operating gas producers. He found gas producers attended by men who did not know the least detail of the procedure. In one instance he found blue prints of the producer put in the safe by the man who was installing it, to prevent the engineer who was to run it from knowing the plan of the inside of the producer. In another instance he found a gas producer in operation with nearly all of the valves closed, while the gas to operate the engine was drawn from the city gas pipes without the attendants knowing what the matter was. In fact, this man could not give any information regarding the use of the valves of the producer. Then many manufacturers believe that their services are less often required if the attending engineer knows too much. There were a few remarks by Mr. F. J. Bulask of Toledo, O., and others, principally centering upon peat power gas, which seems now about to become the great future in the peat industry. It was the opinion of the assemblage that these meetings should be repeated during the next months in different parts of the State, and it was left to the Executive to call an early meeting in the western part of the State, after which the meeting was adjourned, subject to the call of the Secretary.

Informal Meeting of the New York Section.

Since the above date an informal meeting of the Section was held at the Chemists' Club, at 3 p. m. on March 14th. At this meeting it was reported that there were twenty active members in the Section, and other matters of interest were discussed. Negotiations were entered upon looking to a permanent meeting place, probably at the Chemists' Club. It was also decided to call a meeting of those people who live in central and western New York who are interested in the work of the Society, to be held at Syracuse in the latter part of April or first of May, with the hope of being able to form an auxilliary section.

NOTES.

Great interest is at present manifested in the production of power gas from peat for use in internal combustion engines, and many inquiries have been received by the Secretary for definite information regarding this matter. Our manufacturers of gas producers and gas engines have not yet reported successful producers for using peat. The number installed abroad, however, is reported each season to be rapidly increasing, and producer-gas engines are operated successfully at the bogs for the generation of electrical power, which is transmitted to nearby towns for lighting, traction and manufacturing purposes, just as has been advocated for some years by the engineers of the Technological Branch of the U. S. Geological Survey for utilizing low grade coal and coal mine waste at the mines. A marked difference is to be noted, however, in the size of the European peat gas producing plants, compared with those advocated for coal mines. Plants furnishing gas for engines aggregating only 300 horsepower, are built near bogs of relatively small size, generate electricity for small cities in an entirely satisfactory manner, and pay good dividends on the money invested. Such statements as these came from entirely reliable sources; in fact, are reported in full by Nystrom in his "Peat and Lignite in Europe." In the United States we are but slowly grasping the fact that we are behind the times in all matters relating to the uses of peat, and our manufacturers are still wondering if it is possible to use peat fuel in gas producers, some years after commercial plants have been operated in Northern Europe.

Mr. Erik Nystrom, M. E., author of "Peat and Lignite; Their Manufacture and Use in Europe," which was published a year or more ago by the Canada Department of Mines, has

resigned his position with that organization and is now in the western part of the United States, gathering data relative to the use made of lignite in that region. Later, Mr. Nystrom will return to Europe and continue his investigation of the uses of peat and lignite there. His many friends in the American Peat Society wish him the highest success in his new studies.

The Colonial Power & Fuel Company of Boston, Mass., has reorganized, the old officers retiring. The new company is known as the Colonial Power & Fuel Company Syndicate. Mr. Albert C. Day is President and Mr. Charles H. Brown Secretary, with offices at 16 State street.

Word has been received that the new gas producer for using peat, which was ordered last year by the Director of the Mines Branch of the Canada Department of Mines, from Germany, has been received by the officials having the matter in charge, and that the sum of $15,000 has been appropriated by the government of Canada to buy a suitable bog, prepare it for use and erect the plant. It will be remembered that Mr. A. Anrep, of Sweden, came to Canada last year to take charge of the actual production of the peat fuel for the experimental work with this producer; Mr. Anrep is still in America and will continue the work begun last year.

Mr. Robert Ransom, President and General Manager of the Crescent Manufacturing Company, reports that the new plant which he has been erecting near Crescent City, Florida, for making fertilizer filler, is ready to start production and that he believes that it is the best equipped plant of the kind in the country. In addition to making peat filler, Mr. Ranson will soon begin practical investigations, on a large experimental scale, of some of the problems connected with the utilization of peat for other purposes.

Mr. Ernest V. Moore, M. E., of Peterboro, Ont., one of the charter members of the American Peat Society, was awarded the Gowski Medal for original research by the Canadian Society of Civil Engineers, at the January, 1909, meeting of that society. Mr. Moore's research work was upon the properties and manufacture of peat, and the results of his work were presented to the Canadian Society in the excellent paper with which many of our readers are familiar, as it has been published separately and quite widely distributed under the title "The Peat Industry and Its Possibilities."

Journal of the American Peat Society

VOL. II JULY, 1909 NO. 2

HUMUS — ITS IMPORTANCE TO SOIL FERTILITY AND ITS DIRECT APPLICATION FROM NATURAL SOURCES TOGETHER WITH LIME.

(John N. Hoff, New York.)

Read at the Syracuse Meeting of the New York Section.

INTRODUCTORY. "Soils in forest or prairie, unaltered by influence of man, are, as to their mechanical as well as chemical constitution, in every way best adapted to the healthful growth of the vegetation found native thereon. If it may be possible in any way to maintain a virgin soil in as perfect condition as we find it, we may easily enjoy all the "fruits of the earth" with almost as little labor as was demanded of Adam in his first home; but this is as improbable as is a return to the innocence and blessedness of Paradise. But we may realize, in some measure, a Paradise Regained. Who will labor with brain as well as body, with heart and head, doing what is prompted and directed by right thinking, may approach the beauties, and enjoy much of the happiness, of the garden which 'the Lord God planted eastward in Eden.'"—Extract from the Soils of Tennessee, Vol. 10, No. 3, page 36.

All fertile soil is a combination of sand, clay, lime and humus of which sand, clay and lime constitute the mineral or inorganic portion derived from rock decay or disintegration; while humus is the organic portion produced by the decay of all animal or vegetable remains in the soil.

Humus, then, is the rotted remains of previous life which has thus returned to the soil a large part of what it has extracted therefrom, together with the elements taken during growth from the air and water about it, all of which again inures to the benefit of present or future plant life.

Humus varies in composition according to the material from which it is derived. In this connection it is of interest to note the valuable data contributed by Harry Snyder, Journal of The American Society, September, 1897. From Humus prepared by mixing a variety of materials with soil, the mixtures placed in tight boxes and allowed to undergo humus formation for one year out of doors, Mr. Snyder obtained precipitates containing 5 to 12 per cent of ash, with the following ultimate composition on an ash free basis:

Humus Produced by—

	Cow manure.	Green clover.	Meat scraps.	Wheat flour.	Oat straw.	Saw-dust.	Sugar.
Carbon.......	41.95	54.22	45.77	51.02	54.30	49.28	57.84
Hydrogen....	6.26	3.40	4.30	3.82	2.48	3.33	3.04
Nitrogen.....	6.16	8.24	10.96	5.02	2.50	.32	.08
Oxygen......	45.65	34.14	35.97	40.04	40.72	47.07	39.04

Humus from the various sources differs very materially, the nitrogen content ranging from 1-10 to 1% in Sugar Humus to nearly 11% in meat scrap humus.

The value of Humus is usually estimated by the amount of organic nitrogen it contains, as this plant food element is most important, most expensive to supply and most difficult to maintain in the soil.

The presence of lime in conjunction with humus is all essential to give it maximum agricultural value as will be noted further on.

Without humus there is no fertility in the soil and because of its character and action is, with lime, the first portion of the essential soil constituents to be lost in cultivation.

The value of humus is threefold — Physical, Chemical, Biological. Physically, humus will absorb water like a sponge and retain it tenaciously. While 100 pounds of sand will contain normally only 30 pounds of water, 100 pounds of humus will contain 400 pounds of water, or from twelve to sixteen times that of sand. As plants cannot exist without moisture, the importance of a plentiful supply of humus to carry vegetation through a dry spell can readily be seen.

It aids in consolidating a light sandy soil, increases its moisture retaining capacity and prevents leaching out of the soluble plant food in such soil.

In a heavy or clay soil it has the opposite effect, i. e., of loosening and rendering more open such soils which otherwise are too compact and lack proper areation.

It is a great absorber of heat, thus rendering warmer otherwise cold soils, hastening germination and more rapid growth by retaining life-giving heat.

Biologically: Without humus there is virtually no bacterial action in the soil and hence no life, as without bacteria soil is inert. Mayo and Kinsley (Rep. Kansas Exp't. Station for 1902-3) have made elaborate investigations of the numbers and kinds of bacteria found in the various soils of Kansas, in connection with different crops. Five fields with different soils were investigated. The average bacterial contents of the several fields are given as follows:

	Number of bacteria per cubic centimeter.
Field No. 1. Block loam considerable Humus.	33,931,747
Field No. 2. Same as Field No. 1, but with more Humus.	53,596,060
Field No. 3. Thin Soil with clay gumbo subsoil and little Humus.	78,534
Field No. 4. Black loam, but less humus than Fields 1 and 2.	8,643,006
Field No. 5. Black loam, but less humus than Fields 1, 2, 4	3,192,131

"The crop records of these fields for the past ten years indicate that the crop yield has been more or less directly proportional to the bacterial contest of the soil of each field; field 2 has produced the largest yield, field 3 the least."

"The bacterial and the humus content of these soils are sensibly even if not directly correlated; which might reasonably be expected since the organic matter and the humus are the bacterial food." The bacterial content of soil is shown then to bear almost a direct ratio to its humus content and the soil fertility corresponds likewise.

The presence of lime with the humus is absolutely necessary to bacterial action of a beneficial nature, as these little wonder-workers require alkalinity to complete the cycle of changes they bring about, whereby the organic nitrogen in the

humus and the atmospheric nitrogen is rendered available as plant food together with the assistance they render in making available to plant life the mineral portions, phosphoric acid, potash and associated elements.

Chemically: In the presence of lime, heat and soil moisture, humus gradually breaks down, assisted by the bacteria, into simpler elements. During this change carbon dioxide gas is formed which, uniting with the soil water as carbonic acid, dissolves the inert mineral substances and places them in readiness to feed vegetation.

Humus also combines with the mineral elements in the soil, forming humate compounds which carry further stores of plant food, easily available.

A series of field observations with the Minnesota soils which have grown wheat for twenty years and in which the yield has gradually diminished, show on analysis a loss of 60% of the humus content of the soil, with but slightly appreciable change in the mineral portion, as compared with adjacent land of the same character but never broken or tilled, i. e., virgin soil. It was also shown that the yield of wheat was not increased sufficiently to pay for chemical fertilizer where renewal of fertility was sought in this way. The results of the field tests showed profitable gains and a renewal of fertility where humus was used in the form of stable manure or green manuring by plowing under clover. While the value of soluble plant food, as found in chemical fertilizers, is unquestioned, such treatment alone will not restore fertility without the addition of humus in some form.

Finally, humus has a physico-chemical action as a soil disinfectant whereby excreta thrown off by the plant roots, which would kill or injure the plants if again taken up, is rendered inert and harmless.

Worn Out Farms Due to Lack of Humus.

Without question the main reason why so many eastern farms are worn out is from lack of Humus, this being the first soil constituent to burn out or oxidize. With diminishing humus, the soil life declines, the fields are neglected, the lime, also soluble, is washed into the subsoil, leaving acid, consolidated, sterile land.

Virtually all our abandoned farms can be restored to well nigh virgin fertility by rational methods of fertilization.

The question arises, what are the cheapest and most practical methods of restoring the lost humus in the soil?

There are three ways of doing this, all of which can be combined or used separately to meet the conditions represented.

If it be a stock farm where animal husbandry abounds, the animals will supply enough manure to restore both humus and mineral plant food, if the manure is properly conserved and absorbent litter is used to save the liquid excreta-urine, which is practically one-half of the manurial value of the animal and more quickly available as plant food because soluble in water. Manure, in many cases, may not be procurable. It may be too expensive, due to the cost of transportation, or for aesthetic reasons its use may be barred, as, for instance, its unsightliness and stench when used on public parks or lawns.

If manure is available and can be used, ten tons to the acre is the amount usually applied, but where land has long been cultivated twenty tons to thirty tons per acre is none too much. Land is seldom over-manured; the reverse is usually the case. Land is manured yearly or in rotating crops less often according to the character of the rotation. It is best to spread the manure fresh, if possible, to get its maximum value on the land.

The second method, which can be followed alone or in conjunction with the first, is green manuring.

It is a safe rule never to allow land to lie fallow. At the last cultivation of a crop, some legume should be sown, as crimson clover, which will give a good growth even after corn before the following spring plowing. It makes a strong mat, protects the ground and will add 400 to 500 pounds of humus and 50 to 150 pounds of nitrogen in combination with the humus to the acre and return to the soil all the mineral elements the catch crop has absorbed, together with what it has gathered from the fertilizer used on the previous cultivated crop.

When planting grain crops, it is well to sow clover or some legume which will yield highly nitrogenous fodder, and after one or more cuttings, if advisable, it can be plowed under to add humus and nitrogen to the soil. Red and crimson clover are most convenient to use with grain crops, but cow peas, soy beans, vetches and the lupines are of equal or greater value where their growth and habits do not interfere with the main issue, or they may be made the main issue for direct green manuring of the entire crop.

The growing of legumes, of course, to get the full benefit, interferes somewhat with other crops, excluding the use of the land for other purposes for a season. Assuming the average yield to be eight tons of green matter per acre, that is two tons

of dry organic matter (when rotted, which requires some time), the humus added to the soil would not exceed five hundred pounds to the acre.

Application of Natural Humus

The third method which presents itself is the application of natural humus and may be both cheap and practical when conditions favor it. In fact, for public parks, lawns and country places, when green manuring is out of the question and the odor and unsightliness of stable manure excludes its use, natural humus is far and away the best method of restoring virgin fertility to soil, and if used in sufficient quantity, park lawns can be brought into good heart and rendered fertile for years to come by one application, which, though seeming expensive at first cost, will last so many years as to render this method quite reasonable.

In our own and neighboring states, in fact, scattered throughout the temperate zone, are beds of humus or muck, the decayed remains of bygone vegetation. The bogs are vast storehouses of the much needed humus and its constituent nitrogen, natural manure beds. True, if the bog is undrained, the material will be sour or acid not fully decayed and unfit for use as manure. But when the bog has been ditched, drained and areated by plowing and cultivation, the brown muck turns black, becomes sweet, increases its proportion of nitrogen and forms soil of wonderful fertility where growth is almost magical as compared with the hillside farms usually surrounding such deposits.

Where these drained areas occur in a limestone country, the humus will be calcareous and veritably swarm with beneficial soil bacteria.

There is a vast difference in rotted peat or muck from different localities, just as animal manures, depending on the kind of vegetation which formed the deposit and the character and kind of minerals washed in with or without the presence of lime.

A comparison of two peats by Stilwell and Gladding, agricultural chemists, shows this difference to a marked degree:

"To determine the value of natural humus or any decayed organic material, it is necessary to consider—

The state of decay;
The acidity;
The nitrogen content;
The presence of lime;
The ash or mineral residue.

The State of Decay. "The unhumified vegetable matter (unrotted), being of no definitely ascertainable value, therefore forms no permanent feature of the soil." — Hilgard.

The humus material must be well rotted before the nitrogen and other plant food elements can become available.

Acidity. When the humus material is acid or sour, it is prevented from properly decaying and hence the nitrogen and other plant food elements contained therein are not available but are locked up. Furthermore, the acid substances are so injurious to most trees, shrubs and grasses as to stunt or prevent their proper growth. Indeed, when acid, the nitrifying and other beneficial soil bacteria cannot live, and without proper bacterial action there can be no fertility.

The Nitrogen Content. The most important element in organic material is the nitrogen and, other things being equal, the percentage of this element in the actual humus will determine its value. From exhaustive tests made by Hilgard and others, he states, in conclusion: "Broadly speaking, it appears to be necessary to keep the ammonia percentage of soil humus near 5% to insure satisfactory results."

Fertile virgin soils average from 8 to 12% ammonia in the actual soil humus.

The Presence of Lime. This is absolutely essential to good humus, as without lime acidity prevails with its attendant evils before mentioned. The lime neutralizes the acids formed, rendering the humus sweet and stimulates a beneficial bacterial growth.

Humus, in the presence of lime, unites with it, forming lime humates, which in turn combine with phosphoric acid and potash and render these mineral plant food elements available.

The Ash or Mineral Residue. When this is sand or insoluble silica, as is the case when the humus is sour and lacking in lime, the ash content is of no value, while if lime and soluble silica is present the mineral elements are more readily available and of use to the plant.

Sample Peat from Prospect Park.		**Sample Humus.**	
Ash	6.55	Ash	15.90
Containing—		Containing —	
Posphate Acid...trace		Phos. Acid........ .49	
Potash........trace		Potash.......... .05	
Lime.........trace		Lime...........8.36	
Silica..........6.55		Silica..........7.	
Organic matter	93.45	Organic matter	84.10
	100.00		100.00
Containing—		Containing—	
Humus	44.37	Humus	36.40
Ammonia	1.32	Ammonia	4.40
Fibrous and consolidated		Good mechanical condition and process of decay.	

Acid.

The ammonia is below 3% of the actual humus and is, therefore, so largely leached out as to render this material worthless.

Alkaline.

The ammonia is 11% of the actual humus and is therefore very rich.

Hilgard shows from actual tests that the matiere noir or actual humus contributes fourteen times as much nitrogen to the crop as undecayed organic matter.

Conclusion. The sample of Peat from Prospect Park is acid, contains virtually no mineral matter of value and the ammonia or nitrogen is so thoroughly leached out that the material should not be used at any price; it is worthless and therefore no adequate comparison can be made between it and proper humus as to valuation.

STILWELL & GLADDING,
Agricultural Chemists.

The better grade here shows a plentiful supply of lime and is high in nitrogen content. Where such humus is available, it should be a boon to worn out city parks and of great value to market gardens where the drain on humus is so heavy, especially in sandy, leachy soils where too much dependence is placed in chemicals. If such humus were used, the organic matter removed by leaching and continued cropping of the grass, in the case of park lawns, could be restored, and in the case of the market gardens the chemicals used year after year could be made to give up much of their value, which is otherwise wasted. If humus land, after draining, is deficient in lime, if used as manure it will be of little value except in so far as its physical action goes.

Lime. A word here as to lime, so frequently mentioned throughout this article. All cultivated soil should be limed, in addition to manuring, as soon as it shows lack of this essential element, 1,000 pounds to the acre when slightly acid, and 2,000 pounds or more when the land shows strongly sour. Caustic Lime, water slacked, is preferable, applied to the land at once after slacking. The old method of air slacking in the field before application is wasteful, as much of the lime becomes mild carbonate before it is applied, and its action is much weaker than water slacked lime applied at once after treatment. Lime should be applied as soon as the land shows sour.

Remember that Humus in some form should be applied after liming or before, unless already abundant, in order that the land be not impoverished, as lime, while essential, must have organic matter to act upon. If the organic matter is absent, the lime may do more harm than good. Plowed sod land will always show good results because of the organic matter in the sod.

Let us compare the amount of humus in a ton of manure and a ton of natural Humus.

	Ordinary manure.	—Humus— Bone dry.	Sun dry.	Natural.
Moisture	1600	160	800	1400
Solids, containing straw and undecayed matter	300			
Humus matter	70	1540	1022	506
Ammonia	5	80	48	24
Phosphoric Acid	5	10	5	3
Potash	5	10	5	3
Lime and Silica	15	200	120	60
	2000	2000	2000	2000

Values of Plant Food and Chemicals.

Ammonia at	20c lb.
Phosphoric Acid at	5c lb.
Potash at	5c lb.
Manure at	1.50
Humus bone, dry	17.00
Humus, sun dried	10.00
Humus, natural	5.10

Humus Values.

1 ton Humus, bone dry, equals over 11 tons manure.
1 ton Humus, sun dry, equals over 6 tons manure.
1 ton Humus, natural, equals over 3 tons manure.

To Spread 50 Tons Manure per acre.		To Spread 10 Tons Humus per acre.	
50 tons at $2.00..........	$100	10 tons at $4.85........	$48.50
Spreading at $1.00.......	50	Spreading at $1.00......	10.00
	$150		$58.50

Giving 3,500 pounds humus to the acre.

Giving 5,060 pounds humus to the acre.

Plowing Under Clover Crops for Humus.

Cost—

Seed.............	5.00
Preparing land..	10.00
Loss, of 1 season	?
	15.00 plus ?

Average Result—
4,000 pounds green crop.
2,000 pounds dry crop.
400 pounds Humus.

Adding one ton natural humus equals over a crop and land ready for use at once. Cost, $4.85.

You can spread thirty tons natural humus as cheaply as fifty tons manure and get four times as much humus in your soil as from manure, and three times as much nitrogen.

You can spread over 17 tons of sun dried humus as cheaply as fifty tons manure and get five times as much humus as from manure and nearly four times as much nitrogen.

The distinct value of applying a good grade of humus from drained, well rotted peat or muck land can readily be seen.

It saves labor in spreading and is already in humus form, whereas stable manure or a plowed-under green crop may take several seasons to become actual humus. The land is ready for more profitable crop at once when natural humus is used, saving labor, time and land.

Land to be fertile, should contain at least 10% and for prolonged fertility 20% of organic matter. Of the 10 or 20% organic matter, 4 to 8% will be actual humus or matiere noir, as mentioned by Hilgard, who has shown that nitrogen, in the matiere noir, has seventeen times more availability to the plant than nitrogen in the undecayed organic matter in the soil.

The term Humus in this article refers to the total organic matter, including the matiere noir or actual Humus, which term is rather arbitrary.

Matiere Noir. Ordinarily about one-half the total organic matter in soil is matiere noir, or actual humus.

The average worn out soil contains from 2 to 3% actual humus, equal to 4 to 7% organic matter, usually leached out and devoid of lime. To add sufficient humus to

raise this material in the soil one per cent in the first three inches, assuming an acre foot of soil to weigh 4,000,000 lbs. or 2,000 tons, would require five tons. Manure would require 20 to 25 tons to add a like amount of actual humus.

Natural humus contains normally 80 to 85% water, which has prevented is being shipped long distances, because of the expense. A process is now in use whereby the natural humus is sun dried at small cost, so that one ton is equal to three tons of the natural material, and by this method all the virtues of the humus is preserved and such concentration allows it to be transported cheaply.

Humus as Litter. The sun dried or bone dry humus being five times more absorbent than straw and other litter and because of its disinfecting action and power to absorb noxious gases, offers an ideal litter with which to save all liquid animal excreta, which, added to the humus, forms a most valuable fertilizer, being humus plus soluble liquid manure.

Where resoiling is necessary in parks and country estates, a combination of clay loam combined with good calcareous humus in the proportion of three parts clay loam to one part humus, will secure all the conditions of a fertile virgin soil.

Conclusion. 1. That the presence of humus is absolutely essential to soil fertility, and being the first soil essential lost in cultivated land, its loss must be made good by some form of manure.

2. That the presence of lime is necessary in connection with humus, as without lime the organic matter is of little value except to conserve soil moisture and improve soil texture. Biological and chemical action of humus requires the presence of lime.

3. That in general the use of organic matter and lime is a more rational method of fertilization than the use of complete chemical fertilizers alone.

4. That there are three practical methods of restoring organic matter in the soil, i. e.; by stable manure, plowing under green leguminous crops, or the direct application of natural humus from properly treated deposits of humus or muck soil of right composition.

5. That the direct use of natural humus from such deposits is of great advantage where stable manure and green manuring is impracticable.

6. That natural humus, to be fitted for manuring or enriching soil, must contain lime, be free from acid and high in nitrogen content, remembering that if the matiere noir or actual humus should contain less than 4% ammonia as organic nitro-

gen its nitrogenic value is well nigh exhausted. That this element nitrogen should be 8 to 10% of the actual humus content.

7. That the use of natural humus, combined with clay loam, gives a satisfactory method of producing the equivalent of fertile virgin soil.

8. That the use of dry peat or muck humus as a litter enables the farmer to save and return to the land practically all the liquid excreta from the farm animals, which doubles the manurial value of each animal.

A COMBINATION OF GAS-PRODUCER AND COKING CHAMBER.

(Otto K.. Zwingenberger, New York.)

Read at the Syracuse Meeting, New York Section.

The technical use of peat is, in some ways, in an unsettled state, but the fact clearly stands out that besides its use as a filler for fertilizer, packing material and the like, excellent chances are offered by the gasification of peat in the gas producer. If there are any questions on the gas producer for peat which are still to be settled, these are:

1. The question whether to run gas producers with the recovery of by-products and especially of ammonia as ammonium, sulphate, or,

2. Whether it is to be preferred to blow up all the tarry by-products, without any care what becomes of the nitrogen.

As to gas-producers with the recovery of by-products, there is no doubt about it that this system will only pay when it is carried out on a larger scale, and the initial cost for the apparatus is so high that it will nearly double the price of the gas-producer itself.

The condensation of the tarry matter requires a condenser of sufficient length to remove all the tarry particles suspended in the gas. Now the condensation of such fine particles is not so easy, and the task of erecting an efficient condenser is a good job. One will soon find out that the condenser will not do its work if the diameter of the pipes exceeds a certain size, as the tar will not be solidified and one has to take pipes smaller in diameter to give the gas sufficient surface to be cooled by air, otherwise the gas will carry the fine particles into the cylinder and soon serious troubles arise by plugging the cylinder and by pre-ignitions. The price of such an efficient condenser is a considerable item and the work necessary to run

the system in all its details for separating the ammonium, sulphate and the tar is very considerable.

In regard to the recovery of the ammonia from the gas, a part of the ammonia is dissolved in the tar-water coming down in the condenser; its separation from this weak solution cost steam and quicklime. The greater part of the ammonia is still in the gas and can be separated only by a complicated apparatus, consisting of at least two-thirds towers with coke inside, over which sulphuric acid is flowing from the top. The absorption of the ammonia by the sulphuric acid is not such a plain matter in its technical part as it may look at the first glance, for the sulfuric acid must have a certain strength if it is to absorb ammonia in an effective way. Even if one takes the precaution to conduct the sulfuric acid through the towers in such a way that the gas in entering the first tower of the system meets the sulfuric acid, which in passing the whole system has absorbed a great quantity of ammonia and is now so weak that it is nearly saturated; notwithstanding this precaution one has always to handle an acid ammonium sulphate solution.

The pumping of the sulfuric acid from one tower to the other is not a pleasant business, and the whole running of such an ammonia plant needs so much attention and care that it can only be carried out in power plants of several thousand horsepower. The money value of the tar by-products is very little, and cannot be much considered, as they are not sufficient to enable the support of a special by-product plant.

The Mond process for bituminous coal is up to now nearly the only representative of such a process, and is only carried out in some few plants. In the United States there is just one Mond gas plant and that is here in Syracuse. The new modification for peat by Frank & Caro will certainly meet the same fate.

I have always maintained, for instance at the meeting of the New York Section, that by far in the greater number of cases the conditions for power plants run on peat will not admit of an erection of a by-product plant, even in cases when the size of a plant is to come up to 1,000 horsepower, for in peat propositions we have also to figure on the location, freight, etc., and location, and its consequences, give also in these points only too often peculiar aspects.

Whatever the location of a power plant may be, there will always be a demand for power itself and for both air-dried peat and peat coke, or, if necessary, this can be created.

The profit many people are expecting from the sale of the ammonium sulphats make them overlook one fact in regard to

the Frank-Caro process, namely, that a considerable amount of gas produced, more than one-third of it is consumed in superheating the steam for decomposing the nitrogen preparations in the peat to ammonia. It is an old law, as old as the world, that one can't buy anything for nothing, and one has always to pay for an advantage on the one side by a sacrifice on the other. It goes without saying that the use of a great deal of the produced gas for superheating the steam is an item worthy of the greatest consideration, and I would not be surprised if many advocates of the saving of the nitrogen in the form of ammonia have not gone too far into the realization of this fact. It is due to this fact that for power plants of medium size, one does better not to attempt ammonia recovery, but in big plants the conditions in regard to expenses for the several parts of the work are subject to quite a different consideration in comparison to plants of smaller units. For if it comes to the point the output of energy contained in peat, is in the Frank-Caro process, hardly more than 50%, whereas in the Ziegler process, where the coke stands in the front and the by-products in the second line, the output of energy in peat amounts in the average up to 75-80%.

The gas obtained in the Ziegler coking process is relatively very rich. It carries about 330-350 B. t. u. and is an excellent gas for running gas engines on account of its high content of hydro-carbons. It does not run so high as the gas obtained in the distillation of bituminous coal, as, of course, by the destruction of organic matter in peat, the generation of carbonic acid gas cannot be prevented. The conditions favorable for the existence of a Ziegler plant are given only by peat-bogs of considerable size, whereas gas-producers can already live on smaller peat-bogs. Now there arises the question: Could we produce from peat a gas richer than the average gas from producers and coming near to that produced by Ziegler in his coking process?

This question can certainly be answered in the affirmative!

If we combine the gas-producer and coking chamber together in one producer, as is done by my gas-producer, protected by United States patent letter. From peat we can nowadays produce a gas as rich as that from anthracite or coke, and if we take advantage of the hydro-carbons in the volatile matter of the peat, we can manufacture a gas not quite as strong as that of the Ziegler process but which is hardly below 300 B. t. u. as, furthermore, all the tar is transformed into permanent gas. The tar, being nothing but liquid hydro-carbons, transformed into gas, and the hydro-carbons of the vola-

tile matter, represent the best gas we may wish for power purposes. The output of energy of such a gas-producer is equal to that of a Ziegler coke oven, for we are able to draw from one chamber, besides the gas obtained, 25-30% of peat-coke, figured on air-dried peat of 25% water. The resulting coke is not quite as hard as that of the Ziegler process, but it is hard enough to stand transportion and handling.

The principle of my gas-producer consists in the combination of a regular gas-producer with a coking chamber; the latter admits also of the possibility to be run as a gas-producer, in which the process is going on in the same way as in a regular gas-producer run on coke; on the other side it allows easily drawing off the coke if the production of coke is intended.

The producer consists of a regular chamber divided by an upright partition which terminates at some distance below the top. This partition may be diminished at the middle portion and is provided in its upper portion with transverse channels. If a fire is started over the step-grate in the proper chamber, this side is run as a peat gas-producer; all the gases, tarry substances and steam (the latter resulting from the water of the peat on top), pass over the partitions and the channels in the same into the other chamber opposite the partition, where the peat is carbonized by the heat of the gases as well as by the heat radiating from the producer chamber to the other. The gases, tarry matters and the steam pass through the high column of glowing fuel, so that the tarry matters are decomposed and transformed into permanent gas, while the steam acts on the glowing carbon and is decomposed to carbon monoxide and hydrogen. If at the bottom of the second chamber a fire grate is applied, one can run this chamber, too, as a gas-producer, with an outlet for the gas on the side. If the second chamber is to produce only coke, one takes out the coke at the bottom and draws off the gases at the side. Great advantages will be obtained by erecting a series of gas-producers in one continuous line, as the effects of two producer chambers—"A" on one coking chamber, "B" will be more efficient by radiation of the heat; the outlet for the gas in such a case would have to be taken to the front side.

This gas-producer yields a richer gas than any other gas-producer, produces a satisfactory quality of coke in good quantity, and its cost of erection would be even somewhat smaller than that of the average gas-producer, owing to the simple construction.

It has to be stated here, that this gas-producer does not save the nitrogen and its construction was also not intended

for that purpose. What it was constructed for and where its main force lies, is in its great adaptability for both peat and lignite, or even bituminous coal, that it may easily be run in small units of 100-200 horsepower, which may be conveniently united to large systems as the conditions may require.

SOME NOTES ON THE SWAMP LANDS AND PEAT DEPOSITS OF NORTH CAROLINA AND CHEMICAL ANALYSES OF NORTH CAROLINA PEATS.*

(By G. M. MacNider.)

While carrying on the soil survey work for the State Department of Agriculture, the author has taken every opportunity, while working in the eastern part of the state, to investigate the swamp and overflowed lands of that section, with the idea of getting definite information that will be of practical value in developing this large area of now practically useless land. The benefit to be derived from the drainage and utilization of these swamp lands is apparent when it is remembered that there are in North Carolina** approximately 4,130 square miles of swamp lands, or an area equal (roughly) to eight average size counties in the state. The greater portion of these swamp lands are found in the 25,000 square miles*** of rolling and level land constituting the Atlantic Costal Plain in North Carolina.

There are comparatively few areas in the state where peat is found in such form as to make it of commercial importance. The material found in the swamps and classed as peat through this section is composed of loose vegetable matter in varying stages of decomposition, which is wet during the entire year and during the winter and spring is practically covered with water. Consequently the main interest in this subject is from an agricultural point of view.

*See Shaler, "The Fresh-Water Morasses of the United States, Tenth Annual Report United States Geological Survey.

*See also general discussion of peat deposits by Davis, Annual Report Michigan Geological Survey, 1907.

*Published by permission of the state chemist, North Carolina Department of Agriculture.

**Wright, J. O., United States Department of Agriculture, Office of Experimental Stations, Circular 76.

***Holmes, J. A., Bulletin 8, North Carolina Geological Survey.

When the swamp lands are drained and made available for cultivation, the first problem is, of course, the most profitable method of handling the soil. There are, however, large areas of peat and muck which will hardly become of importance as a source of fuel or other commercial use and which, owing to their location, are not suited to agricultural purposes. If the peat in these areas can be used as a manure or fertilizer, it will be a great asset to agriculture in the section where they occur. The investigation of these deposits for the purpose of solving this problem has been made a phase of the study of the swamp lands in the state.

In the following remarks I will give a brief description of the classes of swamp and muck lands examined in this work, with chemical analyses of samples of peat taken from the larger areas in the state.

A large portion of the swamp lands in North Caroline may be classified on their physical composition.* Using this classification, they are put in the Portsmouth series of soils and may be divided into loams, silt loams, fine sandy loams and sandy loams. These soils may be said to constitute the better phase of the swamp lands which are comparatively easily drained. The other large class of swamp lands, which are more properly considered here, constitute that peat and swamp muck lands.

In studying these deposits, it is interesting to note the class of vegetation from which the peat is formed. While the native vegetation is by no means an exact indication of the character of the soil, yet in a general way the character of the soil can be judged from the predominating growth. The forests of the lowland have been classified** into four groups, as follows:

(1) In which numerous broad-leaf trees, chiefly oaks, constitute the greater portion of the growth — the oak flats.

(2) In which gums and cypress constitute the chief growth — the gum and cyprus swamps.

(3) In which the white cedar occurs — the white cedar swamps.

(4) In which the pond pine forms the greater portion of the growth or is the largest tree — pond pine pocosins.

The larger areas of peat and muck are found in the large gum and cypress swamps (class 2). Black gum and cypress are found very generally distributed in all of the swamps, but they are always the dominating species where the soil is com-

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*Using the soil classification of the U. S. Bureau of Soils.

**Ashe, W. W., Bulletin 6, N. C. Geological Survey.

posed of peat and muck. While the soil found in the swamps where the trees of the other classes (1, 3 and 4) are the dominating species, is frequently composed of muck to a depth of one to three feet, it usually contains considerable amounts of mineral matter and is loamy or sandy and is not properly considered as peat or muck. In all of the swamps the undergrowth of bushes, reeds and young trees is very heavy.

Wherever the swamps have been drained, the soil has been found to be very productive. They make excellent corn soils and are very well adapted to such crops as potatoes, cabbages, onions, celery, etc.; but their soils are usually very acid and hence require rather large applications of lime before crops which are effected by acidity can b grown on them.

Throughout the central part of the coastal plain the swamps are found as strips of varying width along the streams. In this section there are few areas of swamp muck and peat which are deep enough and of sufficient extent to be considered in this connection. The material in these swamps is usually a black, heavy, silty, or sandy loam containing a large amount of vegetable matter.

In the extreme eastern portion of the state the swamp areas along the streams are much larger and there are also large areas of swamp which do not follow the streams, but cover large areas of low lying and depressed land. It is this section of the state which will be so largely benefited by drainage. The material usually found in these swamps is very variable in composition. In many of the smaller swamps there is a layer of six or twelve inches of vegetable matter underlaid by a black silty loam. If the swamp is in a very sandy section, the material is frequently a layer of vegetable matter resting on a bed of dark gray or white sand. In the larger areas the muck or peat is from three to twenty feet and more in depth. This material varies from light brown to black in color and is composed of roots, leaves, reeds, moss and other vegetable matter found in the swamps. As the depth increases, the vegetable matter loses, to a large extent, its original structure and the material is a wet fibrous mass of partially decomposed vegetable matter.

Some of the largest areas of peat and muck are found in the Dismal Swamp section, in the northeastern part of the state, and in the vicinity of the sounds in the east central

part of the state. The geology of the Dismal Swamp has been very thoroughly worked up by Shaler.* Throughout this section, besides surface accumulations of vegetable matter, strata of more or less compacted peat, varying in color from brown to black, are found at varying depths below the surface. Some of these beds can be seen in the banks of the feeder canal leading from the main Dismal Swamp canal to Lake Drummond in the center of the swamp. Near Elizabeth City, on the Pasquotank River, there is a large bed of peat, several acres in extent and twenty to forty feet deep. Peat from this deposit was tested by the Fuel Testing Plant at the Jamestown Exposition.

In the counties lying between Albemarle and Pamlico Sounds, particularly in Hyde county, there occur large areas of dark gray and black soil, containing only small amounts of mineral matter, but which are more properly classed as peaty soil. This soil is very productive, but on account of its low-lying position it is wet during the greater portion of the year and the crops are frequently seriously damaged from this cause. During very dry seasons this soil occasionally catches fire and a great deal of damage is done by burning.

Up to the present time practically no use has been made of the large swamps, other than cutting out the timber. The compraatively small amount of draining that has been done has been in the smaller swamps, or the margins of the larger ones. The author has known of a few instances where the peat has been dug out of the swamps and, after allowing it to dry, applied to the land in the same manner as manure. On account of the very acid character of the peat large amounts of lime must be used when this is done. The results obtained by this practice were very satisfactory and tend to show that this is a practical means of utilizing the peat. The chief obstacles in the way of this practice becoming more general are the heavy undergrowth of the swamps, which makes it very difficult to get the peat out, and the high water content of the peat (85 to 90 per cent.), which makes it necessary to take out a very large amount of wet peat to get a small amount of dry matter. With the drainage of these swamps this difficulty will be largely done away with.

There have been analyzed in this laboratory a large number of samples of swamp soil, peat and muck, from various parts of the coastal plain. In the following table are analyses of peat from some of the larger areas, with the analysis of a typical sample of swamp soil of the Portsmouth series:

*Tenth Annual Report U. S. Geological Survey.

Chemical Analyses of Peats.*

Laboratory No.	Name	Apparent Specific Gravity	Volatile Matter %	Nitrogen N—%	Phosphoric acid P_2O_5—%	Potash K_2O %	Lime CaO %	Ash %
572	Peat	0.45	86.00	1.56	0.17	0.25	...	14.00
575	Peat	0.63	51.74	1.62	0.20	0.88	1.09	48.26
855	Swamp Muck	0.61	38.29	0.77	0.07	0.09	0.26	61.71
856	Peat	0.55	58.71	1.15	0.08	0.11	0.18	41.29
868	Peat	0.37	84.92	2.50	0.16	0.45	0.90	15.08
869	Peat	0.43	83.22	2.37	0.08	0.15	0.82	16.78
870	Peat	0.50	65.07	1.53	0.26	0.19	0.46	34.92
872	Peaty Soil	0.66	53.36	0.85	0.13	0.63	0.90	46.64
873	Peaty Soil	0.49	60.71	1.02	0.12	0.14	0.58	39.29
758	Portsmouth Loam	1.00	12.91	0.31	0.03	0.54	0.12	87.09

Description of Samples.

No. 572—Peat, Chowan County. Dark brown peat, composed of portions of trees, roots, leaves and reeds.

No. 575—Peat, Chowan County. Dark brown peat, about 15 feet deep.

No. 855—Swamp muck, Robeson County. Black muck, mixed with silt and clay.

No. 856—Peat, Robeson County. Black muck or peat, about 4 feet deep, underlaid with sandy clay.

No. 868—Peat, Pasquotank County. Dark brown peat, more than 30 feet deep, covering an area of several acres.

No. 869—Peat, Dismal Swamp, Virginia. From feeder canal; black peat from stratum about 5 feet below surface.

No. 870—Peat, Lake Drummond, Virginia. Black peat from the east shore of Lake Drummond in Dismal Swamp.

No. 872—Peaty soil, Hyde County. Typical black peaty soil, which frequently burns during very dry seasons; sample from cultivated field.

No. 873—Peaty soil, Hyde County. Virgin sample same as No. 872.

No. 758—Portsmouth loam, Edgecombe County. Black, silty loam from small swamp; forested to gum and cypress.

Taking up the fertilizing constituents found in the analysis of peat, it is seen that nitrogen is the only fertilizing constituent contained in peat that is present in sufficient amount to make the peat of value as a fertilizer. The largest amount found in the above analysis is 2.50%. It has been shown by Haskins** that only 28% of the nitrogen contained in peat is immediately available for plant food. While the greater portion of the nitrogen is combined in such form as to be unavail-

*All results are calculated on dry basis.

**The value of peat as a fertilizer has been discussed by Haskins, J. Am. Peat Soc., 1, 2, and by Davis, An. Report Mich. Geol. Survey, 1906.

able, still, when large amounts of lime are used to hasten the decomposition of the peat, the nitrogen will rapidly become available for plant food.

Potash is the next important plant food element contained in peat. While the largest amount found, 0.88%, is less than the amount usually present in the average soil of the coastal plain region, it is in much more available form than the potash of soils and will add materially to the value of the peat.

Phosphoric acid is present in still smaller quantity than potash. The amount found in peat is considerably larger than is usually found in soils. This would have been expected, as the phosphoric acid in soils is derived largely from organic sources.

The amount of lime is also slightly in excess of that found in soils.

From the above analyses it is evident that the plant food found in peat is not present in sufficient amount to render the peat, in its present condition, of commercial importance as a fertilizer, but when the swamps are drained and the peat made more accessible it should become of considerable importance as a fertilizer throughout the region where it occurs, and over such an area as the cost of shipping does not make the price of the peat prohibitive. Peat is also of value agriculturally as an indirect fertilizer in improving the mechanical condition of the soil by adding humus to the soil and in rendering available some of the plant food naturally present in the soil in an insoluble form. For this purpose it should be used in the same manner as stable manure. On account of its high absorbent and deodorizing power peat can be used very profitably around stables to absorb the liquid manure, which is too frequently entirely lost. Not only will this save the manure, but the fermentation brought about by such use will render more available the nitrogen already present in the peat.

As the peat in North Carolina occurs in the portion of the state where the soils are most in need of having some form of organic matter added to them, it is to be hoped that with the drainage of the large swamp areas the practice of using peat and muck as a stable litter and manure will become more general.

(North Carolina Department of Agriculture, Division of Chemistry, January, 1909.)

ARTIFICIAL WOOD MADE FROM PEAT—A NEW AND VALUABLE BUILDING MATERIAL.

Freiderich Schuenemann, St. Louis, Mo.

(Read at the Toledo Meeting.)

(Continued from the April Number.)

Below may be found complete estimates of the probable cost of building and equipping a plant for making peat-wood, the costs for labor and production charges for depreciation, and the possible profits of the industry:

INVESTMENT CALCULATION FOR THE PRODUCING OF ARTIFICIAL WOOD FROM PEAT.

I. Total Producing Costs.

Depreciation per year.		
10%	1 steam boiler, from 152 plan, to heat, inclusive of wall and setting	$ 3,500.00
10%	1 steam engine, 130 horse power, inclusive foundation and setting	4,000.00
25%	Belt to drive machinery	1,000.00
10%	Putting in place	500.00
10%	Drying process	1,000.00
2%	Manufactory building	10.000.00
2%	Chimney and lightning rod	500.00
10%	1 Dynamo with 2 electric motors, switchboards, etc.	2,500.00
10%	2 Peat-sting machines, 2 tearing wolves and 2 mull mills.	4,000.00
10%	2 Hydraulic presses to 1,125,000 k.g. pressure including appurtenance for mixing machine, drawing up and transmission arrangements, each $12,000	24,000.00
25%	Electric railroad of 1½ km. length, including tram cars	3,000.00
25%	Patterns and models	5,000.00
10%	Operating machines	2,500.00
10%	Dustless cleaning process	500.00
10%	Locksmith, workshop, turner's lathe, plane and thrust ma hine.	2,000.00
25%	Tools, drawings and other equipment	1,500.00
	Other necessary expenses.	9,500.00
		$ 75,000.00
	Capital stock	$ 25,000.00
	Total amount	$100.000.00

II. Producing Expenses with 2 Hydraulic Presses.

The manufacture of ordinary parkette-slates, one colored, and of 0.50 x 0.50 m. area, is here assumed; results of one pressure with 60 forms, for every rising, 0.50 x 0.50 x 60= 15 sqm. 3 rising an hour, 45 sqm. One day with 10 hours, 450 sqm. Consequently with 2 presses will make in the day 900 sqm.

Men Neccessary to Operate.

6 Men to load and unload the wagon and to work in the warehouse.
2 Men at transporting of lime and clay.
1 Foreman to apply the moistening mixture.
2 Men to attend to the mixing machine.
2 Men to transport the mixed materials to the press.
16 Men (always 8 at one press.)
2 Men to carry away product in little car from the press to the drying-rooms.
4 Men to loosen the forms and to prepare the forms.
2 Men to move product in little car from drying-room to the working-rooms.
4 Men in reserve for extra work.

41 Men at $2 in consideration of the undesirable work...	$ 82.00
1 Foreman. . .	2.50
1 Master. . .	3.00
1 Engine driver. . .	2.50
1 Fireman. . .	2.50
1 Locksmith. . .	2.50
900 sq. m. artificial peat-slates, to finish, etc., at 10c sq. m.	90.00
10,000 kg. are customary 500 sq. m. artificial peat slates to 10,000 kg. to be used 100 cu. meters airdry peat, which after this process costs $15.00; 500 sq. m. artificial peat slates cost for peat, $15.00, consequently 900 sq. m. ...	27.00
For clay and other ingredients...	50.00
3,000 kg. lime, 100 kg. = 50 cents...	15.00
For fuel, machine oil, etc...	8.00
To reserve for unforseen expenses...	15.00
Total cost for production 900 sq. m. for one day....	$300.00

III. General Expenses.

1 Technical superintendent	$ 3,000.00
1 Substitute and traveler	2,000.00
1 Stenographer	600.00
1 Bookkeeper.	1,200.00
1 Apprentice	260.00
1 Porter	500.00
Insurance	1,500.00
Traveling expenses	2,000.00
Reserve and postage	1,140.00
Total amount of general expepnses	$12,000.00

IV. Actual Calculation.

Production for 1 working day = 900 sq. m.

300 working days ×900×300=270,00 sq. m. at sqm. $0.80=	$216,000.00
For actual expense manufacturing for one day, $300.00; for 300 working days, 300×300=	90,000.00
Gross profit	$126,000.00

For Transcribing (Depreciation).

2 per cent upon building ($10,500)	$ 210.00
10 per cent machines and boilers ($44,000)	4,400.00
25 per cent necessary machines—Forms, Tools, Tracks, etc. ($10,500)	2,625.00
10 per cent interest for capital stock in business ($25,000)	2,500.00
Expenses for further experiments	4,065.00
General expenses	12,200.00
Total	$26,000.00
Net profit	$100,000.00

INDIANA PEAT, ITS ORIGIN AND VALUE.

Arthur E. Taylor, Findlay, Ohio.
(Read at the Toledo Meeting.)

(Continued from the April Number.)

From the samples collected by me in the field, twenty-nine were sent to Dr. R. E. Lyons, Professor of Chemistry at the State University of Indiana, for determination of their fuel value. This was done by first repeatedly drying these samples at a temperature of 105 degrees C., until the weight became

constant after each drying. Some of the powder from a peat sample was placed in the bomb of a calorimiter, in the presence of sodium peroxide and potassium chlorate, which furnished oxygen for the combustion. "The bomb was immersed in a nickle-plated copper beaker, containing 2,000 cubic centimeters of distilled water, and the beaker placed in a fiber bucket." After the bucket cover was adjusted, the ignition wire running ready, and a thermometer graduated to 1-100th degree F. placed in position; the charge was ignited by electrical contact, and the maximum temperature registered by the thermometer observed.

By means of this apparatus the Indiana peats were found to have an average heat value of 8,700 B. t. u. The 13 samples of moss peat ranged from 7,211.22 to 10,466.40 B. t. u., with an average of 9,370; while 12 samples of the grass and sedge variety were from 4,541.67 to 9,064.65, with an average of 7,800 B. t. u. Twenty samples of Indiana coal ranged between 11,691 and 13,219.2, with an average of 12.455.1 B. t. u. This shows the peat derived from the mosses to have a fuel value of 3,085.1 B. t. u. less than the Indiana coal and 910 better than peat derived from the grasses and sedges.

Owing to the fact that there are no peat plants in Indiana, the briquettes are little used; but some persons are getting the peat out in the crude condition. That a clear conception may be had of how peat is obtained and burned in the crude form in the Hoosier state, I will tell you of my observations at the home of Mr. C. F. Brown, of Tyner City. Mr. Brown has, according to the state fuel tests, the best quality of peat in the state. By means of a double bladed spade, he throws the peat out in the form of blocks, about 1 foot long and 3½ inches in diameter. These are piled up, so that they are dried by the air circulating between them. However, this process of drying is very crude, at best; since 45 or 50 per cent. of the weight of these peats still remains water.

After becoming as dry as possible in the atmosphere, the blocks are hauled to the woodshed and stowed away for use. Mr. Brown kindly kindled a fire in an ordinary range stove, and the following phenomena were noted: A few pieces of light kindling were ignited. On these were laid some small pieces of peat, well dried, upon which were placed several of the larger blocks. Only 1½ minutes elapsed, after the kindling had been ignited, until the large blocks were well caught, and were giving off a very noticeable amount of heat. At this stage considerable smoke was passing away, and the flames were short and blue in color; but as the process ad-

vanced, the smoke became less and the flame took on a yellow color. The amount of heat developed rapidly increased. After several minutes had gone by, all of the dampers were closed, the stove lids removed, and the smoke and odors allowed to come into the room. The amount of the former was very small, and the latter could little more than be detected. The amount of ashes was less than for an ordinary soft coal, and more than for wood.

The peat moss is being taken out and pressed into bales at Garrett, a town situated in the northeastern corner of the State. This is shipped to various points in Indiana, Ohio, Michigan and Illinois, where it is used with good satisfaction as a litter for stables, fowl-houses and kennels. Mr. Moffer, the superintendent, says "that tests have proven that it will absorb from 8 to 12 times its own weight in water," while the amount of absorption for ordinary straw is not more than three times. Its power to deodorize as well as absorb has made it very valuable for vaults, drains and other receptacles of filth, This litter is sold for $11.20 per ton.

The peats of Indiana are also being used near Ft. Wayne and Knox for the manufacture of a filler for fertilizer. I can say little as to its success as a filler, but know something of its nature as a soil. The Indiana mucks, which are impure forms of peat, contain about 3/10 per cent of potash, the same amount of phosphoric acid and from 3½ to 4 per cent of nitrogen; while a clay subsoil of the State has about 2 per cent of potash, and 1/10 each of phosphoric acid and nitrogen. This indicates that the muck runs very low in potash and high in nitrogen, while the clay has a fair amount of potash, but becomes in a few years deficient in nitrogen. Sand runs much higher in potash and lower in nitrogen than the muck; and straw and barn-yard manure contains considerable amounts of potash.

The effect of mixing muck, clay and sand is very well illustrated on the farm of Thomas Ellison, near Ft. Wayne, Indiana. Here, where Lost Creek empties into Little River, 200 acres are composed of a mixture of muck, clay and sand. This association resulted from the fact that Lost Creek has a fall of 7½ feet to the mile, while Little River has only 1½ feet. At times of flood, the steeper grade developed a strong current in Lost Creek, which, upon meeting the more quiet waters of Little River, slackened its rate and deposited sand and silt upon the muck beds that fill the river valley. Corn crops raised on this mixture of soils are reputed to average at least 70 bushels to the acre, while the adjacent land, composed of

either muck or sand, will scarcely yield 37 bushels to the acre. Numerous other cases were brought to my notice where the farmers would haul sand or clay onto the peat, or vice versa. In all of these instances, the results are said to have been very good.

This improvement in the soils seems to indicate that none of the soils alone contain all of the constituents necessary for plant growth, but the combination furnishes the necessary food. Further, that the peat, which a few inches beneath the surface is always wet, because of the capillary rising of the water from the ground-water level, has this capillary action interfered with, so that the soil can dry out. On the other hand it, to some extent, replaces the dry condition of the sand and clay by a moist one. The various organic acids, which it contains, attack the complex silicates of the sand and clay, breaking them down, through solution, into the more simple forms. This solution, together with weathering, brings on disintegration, which produces a more comminuted form of the material.

Where peat has been put on a sand or clay soil, it has been reported by various farmers that during the first year the peat dries out and does not mix well with the other soils. The crops are even lighter than previously. But after receiving the rains, freezing and thawing of the spring, fall and winter, the soils become well mixed by the second year. When this is accomplished, the annual yield is decidedly better. The kernel of corn, instead of being mealy and thick-shelled, like that raised on the pure peat, becomes firm and large like that produced on the clay and sand. Where the yield of oats on Chas. Fairfield's farm, a few miles west of Ft. Wayne, was only 12 bushels to the acre on the sand, it became 35 bushels upon the addition of muck, and continued thus for several years. In another case, 10 miles southeast of Goshen, the annual crop of onions, at the middle of a peat bed, was only 200 bushels to the acre, but on the margin where the peat and clay were mixed, it was 1,000 bushels the same year.

Up to the present the peat of Indiana has been used but little, outside of experimenting; but as time advances, it is bound to take its place as a raw material for the manufacture of various commodities. Among these, I believe, that the Indiana peat, because of the remoteness of its beds from the coal fields, its cleanliness, and its freedom from smoke, soot, odor and clinkers, will become a very important fuel in the homes of the people living in the northern part of the State.

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EDITORIAL NOTES.

Third Annual Meeting. The Third Annual Meeting of the American Peat Society will be held in Boston, Mass., on September 23, 24 and 25, 1909. The meetings will be held in Room 11 of the Engineering Building, Massachusetts Institute of Technology, and headquarters will be established in some nearby hotel yet to be chosen. The program will consist of papers and discussions on the important phases of the problem of preparing and using peat for fuel, power, fertilizer and other products.

The fact that these meetings are attended by most of the men actually engaged in peat industries in the United States and Canada renders them of especial interest and value, and all of the members of the society and others interested in the use of peat for any purpose are cordially invited to be present.

A full program will be issued later and may be had by writing to the Journal of the American Peat Society, 209 St. Clair Building, Toledo, Ohio.

* * * *

Possibilities of Minnesota Peat Deposits. Not long ago, a newspaper article makes Mr. James J. Hill, the president of the Great Northern Railroad, say that coke may be obtained cheaply from peat, and iron smelted more cheaply in Minnesota than in Pennsylvania. The statement was probably made as reported, as Mr. Hill undoubtedly has made some inquiries in regard to the methods and cost of making peat coke in Germany, and is familiar with both. It is also known that the State of Minnesota has extensive areas of swamp lands, more than most other states of the Union, but very little is known of the extent and quality of the peat deposits in these. Reasoning from what is known of the swamps of Michigan and northern Wisconsin, it is quite safe to estimate the fuel resources of the peat swamps of Minnesota at millions of tons. In one case, for example, a peat bed 8 or 10 feet thick has been cut through for a long distance in one of the openings of an iron mine, and other deposits of large area are known to exist, but nothing is known of their depth and composition. If the state would take up the examination of these deposits systematically, as has been done in other states, a supply of fuel would be made known to the people that would surprise many of them and would be a very welcome addition to the natural resources of a state with so much of other raw materials, but deficient in coal and other kinds of mineral fuel. For some years the matter of using some of the peat from these great stores has been agitated, but, as in most other cases, no permanent industry has yet been established, and, at the present time, but little is being done to produce the material for any sort of product. The peat could be dug, dried and coked or gasified, and would then make most excellent fuel for iron reduction and manufacture. If converted into gas in the gas-producer, a ton of peat gives more power, if the gas in converted into power in a suitable gas engine, than a ton of the best coal does when used under a steam boiler. And yet, in Minnesota, peat fuel is thrown away while coal is imported from Pennsylvania and Ohio to dig it out and toss it aside and to mine the iron ore below it.

* * * *

The Commercial Artificial Fuel Company, of Toledo, Ohio, during the latter part of June, gave an exhibition or test run of their new Peat Mill No. 3, temporarily mounted on a bog in West Roxbury, Mass., near Boston, before a number of busi-

ness men of that city who are interested in the possibilities of peat fuel production in New England. The results of the test were reported satisfactory by the observers, who thought them fully up to the claims made for the efficiency of the machine, and orders are already pending in consequence.

* * * *

Mr. Otis E. Moulton, of Dover, N. H., Vice-president of the New England Section, writes that on account of ill health during the winter and spring months he has been greatly hindered in completing the machinery he has designed for making fuel from peat by briquetting. All who know him wish him a speedy return to health, and hope he will still be able to present to the society at the Boston meeting, full evidence of ultimate success.

* * * *

The Consumers' Peat Fuel Company, of Detroit, is operating a plant near Bancroft, Mich., where some excellent wet process peat fuel is being made. The company's representative reports that the present developments will be extended, as soon as the machinery now being tested has been perfected.

* * * *

Professor H. D. Haskins, of the Massachusetts Agricultural Experiment Station, Associate Editor of this Journal, reports that he has been continuing the work begun by him more than a year ago on the availability of the nitrogen content of peat by making pot experiments for the purpose of comparing the growth of plants grown with peat as a fertilizer, and with various chemicals and raw materials furnishing nitrogen. The experiments have not been completed but they seem to indicate that the nitrogen of peat is relatively low in availability. Other experiments are being conducted to find out methods of rendering the nitrogen of the peat available on a commercially applicable scale, but these have not yet reached a stage where a report can be made as to results.

The investigation is an important one and is along the lines most needed in making the vast resources of nitrogen stored in our peat bogs available for agriculture, and valuable results are certain to come from such work.

* * * *

Dr. S. L. Jodidi, whose interesting paper on the Utilization of Peat appeared in the April number of the Journal, has resigned his position as research chemist at the Michigan Agricultural Experiment Station and has accepted a similar place at the Iowa Experiment Station, where he is now located.

Dr. Jodidi has been carrying on some highly interesting and valuable studies on the nature of the nitrogen compounds

in peat of different types, while at the Michigan station, and a report of progress will soon appear as a Bulletin of the station. It is understood that Dr. Jodidi will continue his research into the composition of peat as opportunity offers, and that work on the Michigan peats will be continued by the Michigan Experiment Station in the new chemical laboratory now nearly completed.

* * * *

New England is the present center of interest in the actual formation and development peat companies, some of which are reported by the newspapers and other sources of information to be installing machinery for experimental production of fuel. A company has been organized at Portland, Maine, which proposes to build a plant at Dexter, to manufacture a fuel from the peat deposits in that vicinity, and which it is hoped may be sold at about half the price of coal.

The officers are: President, A. E. Chase, Portland; Secretary and Treasurer, J. C. Warern, Westbrook; Directors—A. E. Chase, Benjamin Coffin, F. A. Peacock, M. D., Portland; T. Pratt and J. C. Warren, Westbrook. The product to be made is called "Synthetical Coal," and the process was developed by O. A. Ford and F. A. Peacock, of Portland.

* * * *

The Peat Manufacturing Co., organized at Bangor, Me., for the purpose of manufacturing and dealing in peat fuel, with $300,000 capital stock, of which nothing is paid in, filed a certificate at the office of the Maine Secretary of State, the last week in April. The officers were announced as follows: President, Fred T. Dow, Bangor; Treasurer, W. J. Creamer, Stockton Springs. The company has an experimental plant near Bangor.

Of interest, but from a different reason, is the report current in Boston newspapers, that the town of Burrage, Mass., built as a model manufacturing town and supposed to have as its reason for being, the utilization of extensive beds of peat in its neighborhood as sources of power, has been entirely abandoned and the authorities are trying to find some responsible owner from whom to collect taxes, long overdue. It has been reported that the plant was bought by the General Electric Co., but the report has not been confirmed.

* * * *

It is reported that W. V. Lander, of Boston, Mass., has designed a peat fuel machine for the use of a company at Oldtown, Maine.

* * * *

A Bangor, Maine, Special Despatch to the Boston Transcript, dated June 18, states that a new industry, the manufacture of peat bricks, is to be instituted at East Bucksport by a new company formed in that city. A plant has already been erected and the machinery installed. The output at first is expected to be about three tons a day, but will be enlarged as needed.

* * * *

From Reliable Sources It Is Learned that Stone & Webster, consulting engineers of Boston, are conducting a series of large scale experiments in methods of preparing and using peat for fuel and power purposes. It is hoped that the results of this work, when completed, may become available for general use, whether the conclusions are favorable or unfavorable.

* * * *

Under the Firm Name of The Peat Engineering Company of Toledo, Ohio, Messrs. Francis J. Bulask, Herbert Garnett and E. V. Moore have associated themselves in the business of designing and building peat machinery for making fuel and other purposes. They also will examine and report upon peat bogs, and, if desired, will make recommendations as to the best use that can be made of the deposits, and will design and install plants for carrying them out. The members of the new company are well and favorably known to the members of the American Peat Society, and are men of practical experience in the business of handling peat and the machinery for manufacturing it. Mr. Garnett gained experience in fuel and litter manufacture in Europe, and later has had charge of peat fuel and fertilizer filler works in the United States. Messrs. Bulask and Moore's experience is too well known to need repitition here. The Journal and the Society wish them the highest success.

* * * *

Vice President Carl G. Kleimstuck, of Kalamazoo, Mich., reports that he has been so busy during the spring and early summer, arranging for the State encampment of the Michigan G. A. R. that he had been unable to give any time or attention to securing a supply of peat for his next winter's fuel up to July 1. He hopes, however, after that date to find a bog, and make enough machine peat for his own use, as he has a decided prejudice against using coal.

* * * *

Dr. Alfred C. Lane has resigned his position as State Geologist of Michigan and accepted the chair of Geology and Mineralogy at Tafts College, Boston, Mass. As it was largely through the interest shown by Dr. Lane in the peat resources

of Michigan that so much has been done in that state, it is hoped that he will continue to interest himself in peat developments in his new position.

PUBLICATIONS RECEIVED.

Bulletin No. 376, U. S. Geological Survey. "Peat Deposits of Maine," by E. S. Bastin and C. A. Davis.

As part of an extended inquiry into the peat deposits of the country, the United Geological Survey has recently completed an investigation of the peat bogs of Maine.

The field studies of these bogs were made chiefly by E. S. Bastin, of the survey, in the summer of 1906, but a few of the bogs were examined in the summers of 1907 and 1908 by C. A. Davis, principally for the purpose of determining what plants had been most active in forming the peats.

The expense of the work was shared by the federal survey and the Maine state survey commission.

The field tests and analyses recorded in this report show that Maine possesses immense resources of peat of excellent quality for fuel and other purposes. In the southern and eastern parts of the state deposits of good quality are most abundant in Androscoggin, Kennebec and Penobscot counties, and especially in Washington county.

In the northern part of the state tests were made only in Aroostook county along the Bangor & Aroostook railroad. Peat resources as great or greater than those of southern Maine undoubtedly are to be found in the forested lake districts of the northern part of the state.

Their utilization is so remote that testing them for the purpose of the report was not warranted, but they must be considered in estimating the total peat resources of the state. These resources, except for experimental plants near Lewiston and Portland, are at present undeveloped.

The area of peat land actually tested in preparing the report is estimated at 25 square miles. The average depth of the peat is about 10 feet.

It is claimed that the bogs tested are capable of yielding at least 34,000,000 short tons of air-dried machine peat, which, at $3 a ton, would represent a value of more than $100,000,000. It is probable that the deposits tested form only one-tenth to one-fifth of the total peat resources of the state.

In most of the bogs which show any considerable amount of peat the material is sufficiently decayed for use as a fuel, but in a few places the peat is in the main not well decayed, and is

so fibrous that it is better suited for such uses as the manufacture of paper, moss litter, etc., than for fuel.

The report contains an interesting discussion of the nature, origin, character and economic value of peat deposits. The factors that must receive careful consideration before any deposit of peat can be successfully exploited on a commercial scale are also discussed. The failure to consider some or all of these factors in their inter-relations, accounts for most of the marked lack of success in the attempts to use peat in this country.

Properly prepared peat is a good and efficient fuel, and it may be used effectively in a number of manufacturing industries. The unfavorable outcome of most of the business ventures connected with its preparation and utilization has been due, not to causes inherent in the material itself or in the product from it, but to easily preventable errors.

This report may be obtained free of charge by applying to The Director, U. S. Geological Survey, Washington, D. C.

"Peat, Its Use and Manufacture." P. R. Bjorking and E. T. Gissing. (Philadelphia: J. P. Lippincott Company. Price $2.00.)

This excellent little manual of the use and manufacture of peat for fuel has been recently received by the Journal, and, while it was printed in 1907, it is still one of the most recent publications on the subject in the English language, and is especially valuable to those who may wish to examine into the development of processes and machines which have been used in Europe and America. The work contains chapters on the formation, growth and distribution of peat; analyses; methods of digging, cutting and dredging; drying; peat fuel manufacture; nature and uses of peat as a fuel; uses of peat otherwise than as fuel; appendix; bibliography; list of patents granted between 1899 and 1907. The book is well illustrated with some 60 diagrams and half-tones showing machinery of many types, as well as plants in operation. The book is one to which every one interested in peat machinery, or in making peat fuel, should have access.

Annual Report and Prospectus of the Fertile Clay and Peat Company, of Fertile, Ia.

This is a small, well illustrated pamphlet, issued to show what this company has accomplished up to the end of 1908. It is of interest chiefly, as a matter of record of the experiments of the company in using peat as fuel for brick-making, probably the first instance of the kind in the United States.

MINUTES OF MEETING FOR THE PURPOSE OF ORGANIZING THE NEW ENGLAND SECTION OF THE AMERICAN PEAT SOCIETY.

A meeting at which were present about thirty-five or forty citizens, representing all parts of the New England states, was held in the parlors of the American House, Boston, Mass., on February 15th at 6 o'clock p. m., for the purpose of organizing the New England Section of the American Peat Society.

The meeting was called to order by Prof. Chas. A. Davis of the U. S. Geological Survey, Washington, D. C., and on motion Mr. Otis E. Moulton, of Dover, N. H., was elected temporary Chairman and Charles H. Brown of Boston, Mass., temporary Secretary of the meeting.

Mr. Albert C. Day Chairman, S. T. Goodrich and F. M. Frost a committee of three to present to the meeting a list of names to be voted for as permanent officers of this Section. They nominated the following, who were unanimously elected by ballot:

President—Otis E. Moulton, Dover, N. H.
Treasurer—John S. Schumaker, Boston, Mass.
Secretary—N. F. Goodrich, Boston, Mass.

On motion, duly made, the following named persons were appointed by the Chair as a committee to act in conjunction with the officers of this Section, to make arrangements for the holding of the next annual convention of the American Peat Society, to be held in Boston September, 1909: Albert C. Day, Chairman; Dr. C. D. Jenkins, and J. Harry Hartley.

A general discussion of the peat situation was then entered into and remarks by the following named gentlemen:

Prof Chas. A. Davis, Geo, F. Dinsmore, Francis J. Bulask, Dr. C. O. Jenkins, Albert C. Day, J. Harry Hartley, John S. Schumaker, E. F. de Gruchy, Ira Parker, CharlesF. Kittredge.

The meeting adjourned at 11 o'clock, subject to the call of the President, it being understood that there should be several meetings held previous to the annual convention, that the information gathered may be discussed previous to the holding of the next annual meeting.

(Signed) C. H. BROWN, Secretary.

Special Meeting of the New England Section, June 23, 1909.

The meeting was held in accordance with a call by the Vice President, why occupied the chair.

There were twenty members present, and after some preliminary announcements of the dates and place of the annual

meeting, it was voted to make the entire membership of the Section act as a committee of entertainment of visiting members of the Society during the meeting in Boston, in whatever manner they could or as circumstances would permit.

The rest of the evening was spent in a very pleasant manner, discussing peat and its uses, Mesrrs. Moulton and Day taking the lead. W. F. GOODRICH, Sec'y.

PEAT LITERATURE.

For convenience of reference, the following list of works on peat is published here:

State Reports have been issued by New York, New Jersey, Michigan, Indiana and Iowa. These may be had by applying to the state geologists of these states at their respective capitals. The Michigan publication, "Peat, Its Origin and Uses," by C. A. Davis, costs $1.00, postage included.

"Peat and Liquite: Their Use and Manufacture in Europe."

Apply to E. Nystrom, Canada Department of Mines, Mines Branch, Ottawa, Canada. Price 50 cents.

"Peat Deposits of Maine." (E. S. Bastin and C. A. Davis.)

Apply to the Director, U. S. Geological Survey, Washington, D. C.

"Peat, Its Use and Manufacture." (Bjorling and Gissing.)

J. P. Lippincott Co., Philadelphia. Price $2.00.

"Development of the Peat Fuel Industry and Its Possibilities." (E. V. Moore, A. M.)

For sale by the author, Peterboro, Ont. Price 50 cents.

OUR EXCHANGES.

The following articles appeared in our exchanges during the last two quarters:

"Electro-Peat."—The Colliery Guardian

Gives a final chapter in the history of the Electro-Peat Coal Company, Limited, whose process was adopted in this country by the Michigan Peat Co., Eaton Rapids, Mich., and makes record of a judgment against the promotor.

"The Peat Fuel Industry of Canada."—The Engineering and Mining Journal

Vol. 87, No. 18, May, 1909. Gives abstract of the memorandum prepared by the Dominion Superintendent of Mines and presented to the Canadian House of Commons.

"Note on European Peat Production."—Power and the Engineer,

Vol. 30, No. 18, May 4, 1909.

"Peat Deposits of Maine."—Coal and Coke.

Vol. XVI, No. 12, June 15, 1909. Reviews Bulletin 376, U. S. Geological Survey.

"Paper from Peat."—("Inventive Age")

Arrangements being made in Sweden to start a factory this year for the purpose of manufacturing paste-board and wrapping paper from peat. The invention an American one, Swedish peat more suitable for purpose than that produced in United States.

The U. S. Geological Survey.—("Coal & Coke")

"Peat and the Production of Power," by Herbert Philipp,—("Electro-Chemical and Metallurgical Industry.)

Read at meeting of New York Section of American Peat Society.

"Annual Report of the Bureau of Mines," Ontario, Canada.—("Canadian Engineer")

Output of peat was $1,040.00.

"Gasification of Low Grade Fuels," by L. G. Findlay.—(Practical Engineer.")

Greatest agent for the gasification of peat is the by-product ovens from which the by-products, such as sulphate of ammonia, etc., are simultaneously recovered. Oldest of these designed by Dr. Ludwig Mond in Norwich, England.

"Peat Briquettes," from "U. S. Consular Report."—("Mines and Minerals")

New process for preparing peat-fuel invented by a Swedish scientist and is being tried in England. Peat obtained from the bog is first pulped into a homogeneous mass, then heated under pressure to a temperature above 150 degrees. Peat manufacture by this process can be carried on uninterruptedly year in and year out, and price would be much cheaper than coal.

Catalogues Received.

Crossley Brothers, Ltd., Openshaw, Manchester, England. Ammonia Recovery Plants.

Prospectuses.

The International Carbonizing Co., Ltd., 37 Queen Victoria Street, London, E. C.

Lexington Peat Fuel Co., 45 Milk St., Boston, Mass.

The Peat Products Co., Lima, Ohio.

The International Power and Manufacturing Co., Portland, Me., Boston, Mass., London, Eng.

Fertile Clay and Peat Co., Fertile, Ia.

The Peat Manufacturing Co., 53 Exchange Building, Bangor, Me.

A. ANREP — A BIOGRAPHICAL NOTICE.

(A. Anrep, Jr., Ottawa, Canada.)

Mr. A. Anrep has spent most of his time inventing and improving his peat machinery and methods for the utilization of the peat bogs, and at the present time in Europe is considered as one of the most successful inventors in this particular line.

He studied the peat industry in Sweden and Germany in 1868-1869, and especially in Bavaria, where the peat industry in those years had reached a comparatively high standard.

At the experimental station at Haspelmoor he had opportunity to thoroughly study the Gwynn-Exter method for the manufacture of peat briquettes, and other methods then employed for the manufacture of peat products.

In 1873 he invented his first peat machine and during 1874 to 1880 he was employed as engineer for the utilization of peat by the Swedish Iron and Steel Institute (Jernkontoret). During this time he made several improvements on his peat machine with two shafts. He moved in 1880 to Moscow, and received, in 1883, at the International Peat Machine Competition at Bissereva the gold medal for his machine.

On account of the superiority of his machine, it obtained a ready market in Russia and was soon, with few exceptions, the only one employed.

In 1896 he unfortunately became paralyzed and was obliged to keep to his rooms until 1900, when he returned to Sweden and again took up his work with the improvements of his machines.

He established in Sweden, with the assistance of the Swedish government, a peat school, for which he was director during six years, and simultaneously he invented his one shaft machine, which at the present time is the best peat machine constructed.

Other inventions of his are the cable transportation, special elevators, stump pulling machine, and a number of others. He laso improved the so-called field press invented by Jacobson, and worked out the method at present used at the modern plants, where the number of men formerly required is considerably decreased by the employment of these inventions.

At the present time he is working on a mechanical excavator combined with a plant of large capacity, and also with his cable transportation and a special apparatus for the laying out of the peat for drying, which will considerably decrease the number of men required.

Mr. Anrep has been awarded a pension by the Emperor Nicholas II. of Russia and by King Oscar II. of Sweden, a special award of honor, and six gold medals at different international competitions for peat machinery.

Editorial Note: This is the first of a series of biographical notices of men who have accomplished something of note in connection with the utilization of peat, either in this country or in Europe. It is fitting that the series should begin with the present account of some of the results of the lifelong labors of Elder Anrep, who has made so many useful improvements in the machinery used in harvesting peat for fuel and other purposes.

NEW YORK SECTION, A. P. S.

The second meeting of the New York Section, held at the rooms of the Technology Club, Syracuse, N. Y., on May 15th, was highly successful.

Every phase of the peat industry, from the agricultural as well as the industrial side of view, was placed before the audience by eminent peat experts, and so thoroughly discussed, with the result that a regular campaign was laid out for procuring state aid from the legislature for the reclamation of hundreds of thousands of acres of bog land.

Every senator and assemblyman in the state is to be seen personally during the year, by members of the society and others interested in the movement, so that by the time the legislature meets, at least a majority will be familiar with the proposed plan. Great sections of land in central, western and nothern New York have been in a worthless condition for ages because of the lack of drainage. Now it is proposed to reclaim this vast area and use it for industrial and agricultural purposes. By the reclamation of these useless bog lands of New York, including the Cicero Swamp and the Montezuma Marshes, more than $100,000,000 would be added to the taxable value of the state. At present the value of such land is from $2 to $10 per acre. Comparisons of the soil in the vicinity of Kalamazoo, Mich., which has become famous through celery cultivation, was made with samples of New York state bog lands, and shown by data and charts that the productive value of the now valueless bog lands could be brought to an annual earning capacity of at least $100 per acre.

The legislature will also be asked to provide funds for a peat testing plant, under the supervision of either the New York State Agricultural College at Cornell University, or the Agricultural Experiment Station at Geneva, N. Y.

It was estimated that while the state's appropriation for this great project would be comparatively trifling, its value to the state through increased value of the land would be greater than its barge canal.

The afternoon session was opened by the Chairman, F. R. Stevens, of the New York Agricultural Experiment Station at Geneva. He gave a vivid description of all the peat lands in the state, stating locality, size and depth of bogs, and made limits as to its uses in agriculture, or as litter and fuel. An interesting discussion followed, and the speaker was asked many questions, which he satisfactorily answered. The other papers were:

2. Production of Ammonia from Peat, by H. C. Woltereck, London, England.

3. Agricultural Possibilities of the Peat and Muck Land of New York, by M. Earl Carr, of the Bureau of Soils, U. S. Department of Agriculture.

4. Value of Humus and Peat in Agriculture, by John A. Hoff, Agricultural Chemist.

The evening session was again well attended, about one hundred being present, and all showed a deep interest by the many questions asked the speakers.

The following papers were read:

5. Present State of Peat Gasification with Recovery of By-products, by Prof. Chas. A. Davis, Peat Expert, U. S. Geological Survey.

6. A Peat Gas Producer with a Peat Coking Chamber, by Dr. Otto Zwingenberger.

A general discussion followed, lasting until nearly midnight, in which the majority of the audience participated.

It was pronounced the most fruitful meeting of the American Peat Society, and all present pledged themselves to be present at the third annal meeting of the American Peat Society, to be held at the Massachusetts Institute of Technology, Boston, Mass., on September 23, 24 and 25, 1909.

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DRAINAGE OF NORTH CAROLINA SWAMP LANDS.

(Joseph Hyde Pratt, State Geologist, Chapel Hill, N. C.)

For several years the North Carolina Geological and Economic Survey has been making preliminary examinations of the swamp lands of the state in order to determine:

1. The character of swamp; whether the soil is suitable for agricultural purposes or whether it is too peaty in character.
2. Whether the peat swamps contain a sufficient quantity of peat and of such quality that it would be marketable.
3. Whether the swamps can profitably be drained for agricultural purposes.

There are approximately 4,505 square miles of swamp lands in eastern North Carolina, besides thousands of acres of "overflow" land, a great deal of which is susceptible of reclamation, if properly drained.

The approximate amount of swamp land in 28 of the eastern counties in North Carolina is as follows:

County.	Sq. mi.	County.	Sq. mi.
Beaufort	177	Bertie	57
Bladen	192	Brunswick	300
Camden	162	Carteret	126
Chowan	80	Columbus	300
Craven	238	Cumberland	30
Currituck	40	Dare	344
Duplin	125	Gates	45
Hyde	387	Jones	139
Martin	86	New Hanover	25
Onslow	134	Pamlico	325
Pasquotank	80	Pender	370

Perquimans	92	Pitt	40
Robeson	130	Sampson	118
Tyrrell	251	Washington	262
		Total	4,505

Or 2,883,200 acres.

Several areas in Bladen, Carteret, Craven, Duplin, Onslow, Pasquotank, Pender and Wilson Counties have been examined, and in nearly all cases no engineering difficulty stands in the way of draining these lands. In the early history of the state there were three obstacles in the way of the practical drainage of these swamp lands:

1. The cost of clearing the land, inasmuch as the timber had little or no commerical value at that time.

2. The excessive cost and almost impossibility of digging adequate canals and ditches to take care of the water.

3. The lack of adequate laws that would permit the carrying out of a drainage proposition. Fortunately, all these obstacles are now removed; the value of the timber on nearly any swamp area is worth more than the cost of clearing the areas for agricultural purposes; the great advance made in the manufacture of dredges now makes it possible to dig canals of any size at comparatively low cost; and the General Assembly of 1909 has passed an act which makes it possible to carry out almost any drainage proposition.

It may be of interest to the readers of the Journal of the American Peat Society to know something regarding this act. The title of the act is as follows:

"An act to promote the public health, convenience and welfare by leveeing, ditching and draining the wet, swamp and overflowed lands of the State, and providing for the establishment of levee or drainage districts for the purpose of enlarging or changing any natural water courses and for digging ditches or canals for securing better drainage or providing better outlets for drainage, for building levees or embankments and installing tide gates or pumping plants for the reclamation of overflowed lands, and prescribing a method of so doing; and providing for the assessment and collecting of the cost and expense of the same, and issuing and selling bonds therefor; and for the care and maintenance of such improvements when constructed."

Under the provisions of this act, it is now possible for a majority of the resident land owners in any proposed drainage district, or the owners of three-fifths of all the land which would be included in the proposed district, to petition the clerk of the superior court of the county in which the greater portion of the

swamp area is located that he declare such land a Drainage District. The petitioners file a bond with the clerk equal to $50.00 for each mile of canal that it is estimated would have to be constructed to carry out the drainage proposition, such money to be used in paying the cost of the preliminary examination that the clerk of the court has ordered made; provided, such examination shows that the drainage of the land is not a feasible proposition. For making this preliminary examination, the clerk appoints a competent civil and drainage engineer and two resident freeholders of the county, who shall determine:

1. Whether the proposed drainage is practicable or not.
2. Whether it will benefit the public health or any public highway, or be conducive to the general welfare of the community.
3. Whether the improvement proposed will benefit the land sought to be benefited.
4. Whether or not all lands that are benefited are included in the proposed Drainage District.

On the filing of this preliminary report, if favorable, the clerk appoints a certain day when the report shall be further heard and considered, at which time any one interested in the drainage proposed may appear before the court and give reasons why his lands should not be included in the Drainage District, and why he thinks the proposition is not feasible, or why he thinks the cost will be greater than the benefit. If the court does not sustain him in his objections, he has the right to appeal to the superior court of the county in term time; provided he accompanies his appeal with a bond acceptable to the clerk of the court. After the objections to this preliminary survey have all been settled, the clerk shall order that a complete survey and report shall be made of the district, that plans and specifications shall be drawn up showing the locations of the canals and ditches, methods of construction and estimated cost. The viewers shall determine the ratio of benefit that each acre will receive by drainage, and, in making the assessment against each acre, this ratio shall be used. In classifying the lands to determine the ratio of benefits, consideration is given to the degree of wetness of the land, its proximity to the ditch or a natural outlet, and the fertility of the soil.

The land thus benefited shall be separated into five classes:

The land receiving the highest benefit shall be marked "Class A;" that receiving the next highest benefit, "Class B;" that receiving the next highest benefit, "Class C;" that receiving the next highest benefit, "Class D;" and that receiving the smallest benefit, "Class E." The holdings of any one landowner need not necessarily be all in one class, but the number

of acres in each class shall be ascertained, though their boundary need not be marked on the ground or shown on the map. The total number of acres owned by one person in each class and the total number of acres benefited shall be determined. The total number of acres of each class in the entire district shall be obtained and presented in tabulated form. The scale of assessment upon the several classes of land returned by the engineer and viewers shall be in the ratio of 1, 2, 3, 4 and 5—that is to say, as often as 5 mills per acre is assessed against the land in Class A, 4 mills per acre shall be assessed against the land in Class B, 3 mills per acre in Class C, 2 mills per acre in Class D, and 1 mill per acre in Class E. This shall form the basis of the assessment of benefits to the lands for drainage purposes.

When this final report is handed in to the clerk of the court, he shall notify all the landowners that upon a certain date there will be a hearing of the said report at which any landowner may appear in person, or by counsel, and file his objections in writing to the report of the viewers. It shall be the duty of the court to carefully review the report and the objections filed thereto. If, in the opinion of the court, the cost of construction, together with the amount of damage assessed, is not greater than the benefits that will accrue to the land affected, and if the assessments are just and equitable, the court shall confirm the report of the viewers and declare the Drainage District established. If, however, the court does not confirm the report, the proceedings shall be dismissed at the cost of the petitioners. During the hearing of this court, any landowner has the privilege of appealing from the decision of the court to the superior court in term time, and the establishment of the Drainage District is delayed until such appeal is settled.

As soon as the Drainage District is declared established, the court shall appoint three disinterested persons, who are known as the "Board of Drainage Commissioners," and they are immediately created a body corporate under the name and style of "The Board of Drainage Commissioners of ——— District." This board of commissioners has the power to issue bonds of sufficient amount to cover the cost of drainage, the land being collateral for the bonds, none of which can be sold below par. The bonds are thirteen-year bonds, payable in ten installments, the first installment to be due at the end of three years from the issuing of the bonds, the same to bear 6% interest. The money necessary to pay the interest and bond issue is raised by assessment on the land, according to the benefits derived, as mentioned above. This assessment constitutes the first and paramount lien, second only to state and

county taxes, upon the land assessed, and is to be collected in the same manner and by the same officer as state and county taxes.

Provisions are also made in the act for crossing land with a ditch, for crossing highways and railroads, for notifying the railroads of such crossings, and for assesments of damages upon them and upon individuals. Provision is also made for the control and repair of the canals and ditches after they have been once constructed. In order to protect the ditches, canals, levees, etc., that have been constructed in carrying out the plans for the Drainage Districts, the act makes it a misdemeanor for any person to injure or damage or obstruct in any way these ditches and canals.

As a result of the passage of this act, six drainage districts are already in the course of formation: one in Currituck County, known as the Moyock Drainage District; one in Hyde County, which contemplates the drainage of Lake Mattamuskeet and about 70,000 acres adjoining it, making a total of about 120,000 acres in the drainage district; another in Beaufort County, north of Belhaven, containing approximately 25,000 acres; 4,000 acres in Pender and Duplin Counties, known as Angola Bay Swamp, containing possibly 47,000 acres; 5,000 acres in Pender and Bladen Counties, which contemplates the reclamation of a large and fertile area in Lion Swamp, and 6,000 acres near Wilson, Wilson County.

Work has already been commenced in the Moyock District, the Wilson, and one in Beaufort County. Plans and specifications have been drawn up for the drainage of Lake Mattamuskeet, Angola Bay and the Lion Swamp areas. An application has also been received for the establishment of a Drainage District in Chowan County. The above will show the interest that has already begun to be taken in the drainage of North Carolina swamp lands. It has been known for a long time that many thousands of acres of these swamp lands contain the most fertile soil to be found in the state, and now that the General Assembly has made drainage possible, there is plenty of capital ready to undertake the drainage of these fertile swamp lands, realizing that they will be able to dispose of the lands at a good profit after they have been thoroughly drained.

The drainage of the vast swamp areas of eastern North Carolina means not only additional wealth to the state, in the form of reclaimed agricultural lands, but it will mean improved roads through large areas that are now practically impassable and inaccessible. It will also mean better school facilities for the children and it will greatly improve the healthfulness of this section of the state.

THE "IRISH PEAT QUESTION."

Herbert Garnett, Eaton Rapids, Mich.
(Read at the Toledo Meeting.)

Having been requested to give an account of the many uses made of the Irish bogs, chief of which is fuel, I will describe briefly the principal methods employed by the peasantry for saving their yearly crop, and the efforts put forth by the Department of Agriculture to assist the farmers in procuring a cheaper and more serviceable fuel. There are in Ireland 1861 square miles of bog land, of which the greater part is in the three counties of Donegal, Mayo and Galway, three of the poorest counties in the country.

While the average thickness of peat beds in Europe is nine to twenty feet, Ireland has peat as deep as 40 feet, the average being 25 feet. At present, with few exceptions, Irish peat is used as fuel and this is prepared in a very slow and costly manner. Most of the bogs consist of pure sphagnum or peat moss, cotton sedge, beaked sedge, rushes, certain grasses, pines, etc., the nature of the flora being dependent on the kind of bog, whether high peat bogs, fens or morasses; sphagnum and heather are characteristic of the high peat bogs and are absent from the morasses where the moss, hyphum, rushes and sedges are chiefly found; the surface of a bog may thus be pure peat moss or a varied mixture of plants into which sphagnum itself may not even enter.

As most of the low lying bogs are too soft to carry the weight of horses and cattle, the growth of the bog plants is unhindered, and as the sphagnum mosses are rapid growers, a bog will sometimes increase in thickness each year from two to six inches, which sinks in the fall, to say about one-half inch, while the high, or mountain bogs, containing little or no sphagnum, increase in thickness very slowly and rarely exceed six feet deep, but are composed of dense black peat, making an excellent fuel.

The following is an illustration of how an Irish farmer holding twelve acres of farm land supplies himself with fuel from a typical bog, and allowing for variation in details, the same system prevails all over Ireland. During the winter notices of "Con-Acre" bog for sale, are posted up by the bog owners and on the appointed day the farmer whose case is given attends the sale and buys, say six perches of bog at about $1.00 a perch. He is not asked for immediate payment but has to settle up before he removes his peat. The price

mentioned appears to work out at about $160.00 per acre, but the farmer does not really buy six perches of bog. What he does buy is as much mud as he can spread over the six perches of bog he has bought, less the space occupied by the hole from which he digs the mud, the area of which will average one-half perch. Having bought the piece of bog, the farmer will commence digging about the end of May or early in June. The first process is to roughly level the drying ground and strip the place where the bog hole will be made. This means he digs off about four or five feet of the upper moss, throwing it into the hole formed the previous year by the excavation of the last lot of fuel. This work completed and the surface of good black peat exposed, three or four men commence to throw the peat from the hole, while others break it up with forks and mix it, tramping and turning it continually, as the top layers are light and the lower layers heavy and consist of peat of different ages and qualities; the whole mass must be thoroughly mixed when thrown on the bank.

As soon as the mixing is completed, the mud is wheeled in barrows and spread over the drying ground to a depth of nine to twelve inches, then one man shapes the peat with his hands and cuts the sods by drawing the side of his hand across each run at intervals of twelve inches. In ten days, with good weather, the peat may be footed. That is, the blocks are stood on end in little piles of seven with two crossways on top. In another week they are refooted, that is, two piles are put into one, and if favorable weather continue, they may be stacked in four weeks' time ready to be carted home in the fall. When dry, that is about 25% moisture, the crop saved from these six perches would weigh about fifteen long tons and the cost of digging, mixing, footing and carting home would be about $2.50 per ton. Although this is the method generally adopted on the low-lying bogs, those who are fortunate enough to be near a mountain bog have only to dig the peat in blocks about sixteen inches long by seven inches square, which are wheeled on to the drying ground, then footed and refooted and stacked, the mixing process necessary with the lighter peats not being required.

Although the foregoing method of peat fuel manufacture appears slow, and costly, to those of us who have studied the question from a mechanical point of view, it is interesting to note that these Irish farmers have used for centuries the only practical method of converting an almost useless bulky mass of peat into compact and dense fuel, and that no method yet devised has improved on their work except to do by machinery what they did with their feet, but the principle of condensing

peat is exactly the same. Further, their mode of drying in the sun and air, without any covering from rain, snow or frost, is still today the only one adopted by successful peat fuel makers, but in spite of this long-established fact, we constantly hear of schemes proposed to artificially dry peat fuel, all of which ventures die a natural death and prove another blow to the establishment of a legitimate and profitable industry.

In all normal peat there are two waters, "loose" and "latent," or "water in combination." The loose water can easily be drained out, but the water in combination has thus far baffled all attempts at its forcible ejection, and as it is impossible to compress water into less space than nature intended, it is useless to try to condense or compress peat while wet, as the composition of peat is such as to render compression unnecessary to form solid blocks. All machinery built to work on these lines has failed because the principle was entirely wrong.

Before attempting to describe the principle involved in peat drying, it is expedient to explain the chemical change that under special circumstances takes place in peat and adds to its solidity. There are two chemical bodies, pectose and pectin, the chemistry of which is outside our subject. Pectose is said to exist largely in unripe fleshy fruit and vegetables, and during the ripening of fruit the ferments and acid present convert the pectose into a soluble substance termed pectin. Pectic acid is a jelly-like substance which on being dried becomes like horn. Pectose is an anhydrate, while pectin is a hydrate. In unripe fruit, pectose the anhydrate, while changing into pectin the hydrate, enlarges, softens and ripens the fruit. The opposite process takes place in the peat, as the adjunct is the hydrate (pectin), while it is changing into the anhydrate (pectose), the peat contracts, gradually hardens and changes into hornoid, or a substance allied to mineral coal, but nature must have her own time to effect this change, and when we try and improve on nature's work by hot air blasts, we first dry off the surface of the blocks and form hornoid, then, on the block becoming heated through, steam or rather water vapor, is formed inside this shell of hornoid, which, being unable to escape, cracks the blocks asunder to find an outlet. Any attempts to dry peat in less time than nature, with its chemical changes will allow, have proved futile. It is understood, however, that for the change to take place rapidly all the latent water should be loosened by the trituration or puddling of the peat and that the reaction is more rapid when the peat, after puddling, is dried by the sun and wind, than by any application of artificial heat. Thus, in a March gale the changes would take place more rapidly than on a sultry hot day in summer.

Once the drying process begins so also the chemical change, the intensity of the latter being rapidly developed in a ratio with the contraction, the contraction squeezing out all the moisture and thus completing the change from the hydrous (pectin) to the anhydrous (pectose). Necessarily the new substance has different characters, due to the raw material. Dense black peat will produce a result as hard and in aspect and structure similar to ebony, while the fibrous peat will still show the fibres.

We have yet another important lesson to learn from the Irish farmer. That is, the most practical mode of drying the peat after treatment by puddling. He has no shed or covering of any kind. No elaborate system of dryers, fans, heaters or steam engines. Only Mother Earth to put the wet blocks on, and the sun and wind. The two latter items do not cost anything in the first place, need no repairs, furnish no coal bill and, as uncertain as is the climate of Ireland, there are thousands of tons of good peat fuel dried annually with no cost except turning by hand once or twice to hasten the drying process, which operation could be dispensed with in this country when working on a well-drained bog, and although all kinds of covering such as sheds, racks and mechanical means have been tried during the last one hundred years or more, there is not one manufacturer that I have ever heard of who has finally adopted these methods and finds them successful.

In the first place, it takes nearly a ton of rough timber to hold a ton of dry peat fuel, and the saving in handling claimed by advocates of this system does not by any meeans pay for the cost of drying sheds. I have tried it. In the second place, the principle of drying on racks or boards under cover is practically and theoretically wrong. There is such a thing as trying to dry peat too quickly and thus cause cracking. It is absolutely necessary to give the blocks time to undergo the chemical changes previously mentioned, and as peat is almost purely vegetable and therefore a bad conductor of heat, it is far more serious problem to handle than most people imagine. By exposing the peat to the air for drying, the pectin on the outer surfaces of the blocks in a few hours is converted into pectose or hornoid, which, on becoming hard, forms a shell or casing all over the blocks, which casing is almost water-proof and will not allow the water contained in the block to come out nor will it let the rain, snow or dew penetrate the block except under very continuous and heavy showers, so as the blocks after exposure make their own roofs, there is no need for the peat fuel manufacturer to trouble himself.

Another point which finally decides the most correct

method of drying is that when the blocks are dried on racks or boards under cover, they dry at all points at the same time, thus forming hornoid all over their entire surface and shutting in the contained water; whereas when dried on the ground, the grass or moss on which they are laid keeps the bottom side moist, preventing the formation of hornoid, therefore leaving a free outlet for the moisture, while the contraction on the upper exposed surfaces rapidly takes place, driving off the moisture through the bottom, where it is absorbed through the grasses and mosses into the atmosphere. Peat fuel that will crack to pieces when dried on boards or racks will, in almost every case, dry perfectly on the ground for this reason. From the time the wet peat is formed into blocks till they can be stacked or stored, is in Ireland about four weeks, but it is better to allow them to remain together four weeks or longer before burning. This appears a long time to wait till the fuel is ready for the market, but it must be remembered you are getting rid of eight tons of water for every ton of fuel sold, at no cost for evaporation except the rent or interest on the ground covered by the peat, and in this case it pays to wait to have your work done free of charge, especially as there is not yet any other method.

Peat fuel making by the wet process and sun and air drying is necessarily a summer business, and those who are not satisfied at the time taken to dry the peat and advocate an all the year around process should stop to consider why hay, straw and corn cannot be cut and saved at Christmas and why ice is not cut from the rivers and lakes in the summer, when it is most needed. If the summer is not long enough to save a large enough crop of fuel, then increase the output. The cost of a complete plant to manufacture twenty-five tons of dry peat fuel per day of ten hours should not exceed $5,000.00. If it does, there is something wrong.

In June, 1903, the Department of Agriculture and Technical Instruction, an institution run much on the lines of your State Colleges, sent Mr. Tatlow, their peat expert, with a German machine driven by two horses to a bog in County Cavan to demonstrate the process of machine-made peat, which was a great success, as the season being very wet, none of the hand-made peat was saved in that locality and that made by the machine was the only dry peat saved. The following year the Department procured a steam-driven plant with an output of twenty to thirty tons peat fuel daily, which also made cheap fuel, but the cost of these machines prevents their general adoption by the farmers, who still continue the old methods of hand labor. The Department then installed two peat litter

presses and a peat fuel machine in a factory built by a man in the south of Ireland, where for two seasons good peat fuel was made, bringing a high price and proving a benefit to the people, but so far as I know this plant is not now in operation, owing to some trouble arising regarding the purchase price from the Department. It is to be regretted that their efforts have not met with hearty support, but anyone who understands the temperament of the typical Irish farmer can readily understand the reason.

The fuel machine just mentioned and one in the North are the only ones I know of in Ireland, although there have been scores of attempts to manufacture peat fuel, all of which, however, have proved failures and the machines consigned to the junk pile. All these attempts have been along the lines of drying by artificial means, then briquetting under enormous pressure with or without the addition of binding material; a process exploited in Germany years ago and abandoned. In 1902, on returning from an extended trip through Canada, I organized "The Irish Peat Development Company" and erected a factory in County Armagh, which today turns out about two hundred tons of peat litter in bales, used for horse and cattle bedding, and about the same quantity of peat mull, or dust, weekly, packed in bales of burlap and shipped chiefly to the Canary Isles for fruit packing for export.

Although we worked a peat fuel-making machine as an experiment for two seasons, we finally gave it up, as the peat was more suitable for litter and made more money in that form than made into fuel. At Carrichmore, County Tyrone, there is another peat moss litter factory owned by the same company, with a possible output of fifty tons of baled litter and dust daily. There are also several other moss litter factories in operation in Ireland, but as they are situated more inland and away from waterways, their export trade is not very large owing to excessive rates charged by the railway companies.

The opening for a new and perfect fuel, such as peat is, in this country is very large indeed. Soft coal is dirty and uncertain. Hard coal is high in pricee, with little prospect of becoming cheaper. Wood is getting more scarce, the country is growing in population, so there should be ample room for another fuel, far superior to wood in heating qualities, far cleaner than soft coal, and half the cost of hard coal, entirely free from sulphur, forming very little ash, nearly smokeless, clean to handle and cheap to buy, and as peat fuel ought not to cost more than $1.00 per ton to manufacture and would be cheap to the user at $3.00, there is profit enough to induce financial men to give the matter serious consideration, but I

would strongly advise all who contemplate the establishment of such an industry, before deciding on a plant for this purpose, to take a trip to Europe and investigate the methods adopted there and learn how to do it. Then follow strictly on the lines of successful makers, leaving others to experiment with new fangled processes with high-sounding names, which are good for stock selling but useless for peat fuel making, nor will they "cut any ice" in summer.

EXHIBITION OF PEAT PRODUCTS AND MACHINERY.

The New York Section of the American Peat Society announces that it will hold an exhibition of peat, peat products and all matters pertaining to their manufacture, in February, 1910. The co-operation of the members of the Society is earnestly solicited to make this exhibition a success, and contributions of peat and products made from it, models, drawings, blue-prints and photographs of machinery, plants and bogs, literature descriptive of machinery and processes and all other matter pertaining to the real or prospective utilization of peat.

This exhibition will be held at the Chemists' Club, New York City, and will attract the attention of the members of that Club, and of the Engineering Societies of New York generally.

If the exhibit is the success it is hoped it will be, it may be deposited permanently in one of the technical museums of New York. Let every one contribute.

All communications and inquiries regarding this exhibition and material for it should be addressed to the Secretary, Julius Bordollo, Kingsbridge, New York City.

LIST OF PERIODICALS RECEIVED BY THE SOCIETY.

"Gas Engine," No. 242 E. 7th St., Cincinnati, O.
"Stevens Institute Indicator," Hoboken, N. J.
"Engineering and Mining Journal," 505 Pearl St., New York.
"Power and Engineer," 505 Pearl St, New York.
"Cassier's Magazine," 12 W. 31st St., New York.
"Engineering Review," Flatiron Bldg., New York.
"National Engineer," 325 Dearborn St., Chicago.
"Canadian Engineer," Toronto, Canada.
"Inventive Age," Washington, D. C.
"Gas Power," St. Joseph, Mich.
"Mines and Minerals," Scranton, Pa.
"Engineering Digest," 220 Broadway, New York.

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EDITORIAL.

The third annual meeting was the most important yet held by the American Peat Society, in several respects.

More of the men actively interested in actual peat operations were present than have attended any previous meeting; the papers read were practical rather than theoretical; and most of those who were present brought cheering reports of progress.

The sessions were generally well attended by the people of Boston and the neighboring towns and these visitors manifested much interest.

It was decided at the meeting to publish the proceedings, including abstracts of all the papers read, in this number of the Journal, then nearly due.

The preparation of this matter for printing, however, took longer than was anticipated, and this and other reasons that need not be mentioned, are responsible for the delay in the publication of the current number.

It is hoped that its quality and interest will in some degree make up for the tardiness of its appearance.

American Peat Society

THIRD ANNUAL MEETING, BOSTON, MASS.

PROGRAM OF THE MEETING.

1. Opening Remarks by the President..........Dr. Joseph Hyde Pratt
2. Report of Officers.
3. Committees' Reports.
4. Nomination of Officers.
5. Early History in the Production of Light, Heat and Power from Peat......................George F. Dinsmore, Boston
6. A Written Discussion...................John S. Schumaker, Boston
7. Future of Peat in Canada........................James M. Macoun (Canadian Geological Survey)
8. What I Have Accomplished in the Manufacturing of Peat Fuel.................................Philip Heseltine, Detroit
9. Peat Machinery and Production of Peat..J. H. Van Glahn, Toledo, O.
10. The Peat Trip that Petered Out..Carl Kleinstueck, Kalamazoo, Mich.
11. Peat in Maine.......................W. J. Creamer, Bangor, Maine
12. Peat Investigations of the U. S. Geological Survey...Charles A. Davis
13. Election of Officers.
14. Peat Briqueting.......................O. E. Moulton, Dover, N. H.
15. Chemical Products from Peat..............Prof. Charles A. Davis (U. S. Geological Survey.)
16. Methods of Drying Peat.
17. Continuous Vacuum Filters as Dewaterers...Robert Schorr, San Francisco
18. Making Peat Briquettes by the Milne Process, and
19. Mallock's Peat Drier ....Dr. J. McWilliams, London, Canada
20. The Cost of Preparing Peat for (1) Fuel, (2) Moss Litter, (3) Fertilizer Filler.
21. Peat in Agriculture.........................Prof. H. D. Haskins (Mass. Agricultural Experiment Station.)
22. Is the Use of Peat in Fertilizers Justifiable?
23. The Manufacture of Peat Coke.....................W. L. Shepard
24. The Use of Peat in Gas Producers..........D. T. Randall, Boston
25. Peat Test in an Akerlund Gas Producer...The Gibbs Gas Engine Co., Atlanta, Ga.
26. Reclamation of Swamp Land................Dr. Joseph Hyde Pratt
27. The Manufacture of Peat Litter..........W. F. Todd, Calais, Maine

Saturday. September 25th, 1909.

Excursion proposed to Peat plants in operation.

The meetings of the society were held at the Massachusetts Institute of Technology, in Room 11, Engineering Building B.

The first session was at 10 o'clock, Thursday, September 23, 1909.

In the absence of the President the meeting was called to order by Mr. Ranson, of St. Augustine, Fla., Vice-President for the Southern States.

The full list of members, prepared by the Secretary, was read by the Chairman.

Voted: That the reading of the minutes of the last meeting be dispensed with as the same appeared in the Journal of the Society.

Mr. Kleinstueck, of Kalamazoo, Vice-President for the Section of the Mississippi Valley and Great Lakes region, stated that there was but little to report in the way of progress in his section. During the past year he has been called upon to answer many inquiries by correspondence, several being received from Iowa. He went to Mason City, Ia., to look over the deposits now owned by the Fertile Brick and Peat Fuel Company and found the peat running to a depth of 14 feet. The manager of the plant has recently sent photographs showing the plant to be in full operation and it appears they are extremely busy there. He had also visited Indiana within a short time and finds many interested there, of whom some have become members of the Society. In visiting the states of the Mississippi Valley he found no progress in the peat industry.

Mr. M. R. Campbell, of the United States Geological Survey, Vice-President of the Eastern States Section, being absent, Mr. Davis stated that there were no new plants in operation in the different states in that section and called attention to the fact that in the region immediately south of the Great Lakes there were at least six peat fertilizer filler plants in operation this year, and a fuel plant planned to be operated near Pleasant Lake, Ind., where peat is to be made into briquettes, and one in operation at Bancroft, Mich. Both of the fuel plants referred to are to be described in papers to be read later, so no consideration need be given to them at this time.

Dr. McWilliam, of London, Ontario, Vice-President for Canada, stated he knew of but one plant in Canada making fuel at present and that is located near London. In regard to his own plant he stated he had devoted a few years to experiment in using peat dust as fuel with blast burners and had found that the dust required to be bone dry to obtain its full efficiency, so that it was necessary to get the last drop of water out, a very difficult process. He also called attention to the fact that it was difficult to obtain a chopper to reduce peat to fine dust that would do the work well. He has used a Joliette chopper and recommends that, if possible, some new invention be devised in order to make peat dust firing more successful, as it is difficult to chop the peat fine enough with any device that he knew of now. The peat is very hard to grind and wears out the choppers very fast. When peat powder is burned it seems to burn well, but causes a coating on the flues and fire box and heavy smoke and fire to come from the smokestack. For this reason

and others unnecessary to mention, for the time at least, he had abandoned the use of peat powder for fuel at his plant.

Mr. Davis stated that in New York there has been practically no progress. There were meetings in New York City in February and in Syracuse in May, for the purpose of forming a strong New York Section. Those meetings both had been largely attended and the people seem much interested. During the summer attempts were made in the Adirondacks to make peat litter in a purely experimental way by Mr, F. R. Stevens, Vice-President of the New York Section. There is also a plant near Fishkill Landing, N. Y., for making peat into fertilizer filler and where some moss is baled, but no extensive operations have been carried on in New York this year. A plant at Ogdensburg was destroyed by fire last October and has not been rebuilt at last accounts. An article in the Scientific American describes a new device invented by Colonel John Jacob Astor to further the use of peat in gas producers, which has been widely copied in the newspapers, but Colonel Astor has not yet built the device or a peat gas producer. Mr. Davis also stated that further information on the peat industry would be given in a paper later on.

The financial report of Secretary-Treasurer was then read as follows, and on motion the same was accepted.

Financial Report.

1908, Oct. 31. Cash on hand		$ 77 66
Dues from members	$ 360 00	
Advertising and extra sales of Journals	152 77	
Total receipts		$ 512 77
		$ 590 43

Expenditures.

Printing of Journal, 4 numbers	$ 200.00	
Mailing, stationery and sundries	129 98	
Total expense of Journal	$ 329 98	
Organizing N. Y. and New England Sections	$ 58 50	
Stationery, postage and sundries	83 65	
Total expenses		$ 472 13
1909, September 21. Cash on hand		$ 118 30

Messrs. Davis and McWilliam were appointed an Auditing Committee to examine the financial report of the Secretary-Treasurer.

The report of the committee on securing lower freight rates was read by the Secretary.

The committee consisting of Herbert Philipp, Perth Amboy, N. J.; O. E. Moulton, Dover, N. H., and Julius Bordollo, New York City, submitted an exhaustive and very full report, which will be published in full in a later issue. The committee reports that peat fuel manufacturers were the only makers of peat products who had complained of freight rates, and that in the year since the appointment of the committee, there had been "not one peat fuel manufacturer doing business and shipping in bulk over a railroad." It was therefore decided that there was nothing to work on or to bring to the attention of the Interstate Commerce Commission or any railroad association, hence it was necessary "to await a real case of large and continuous shipments on which to build our cause."

Voted: That the report be accepted and that the committee be continued to inquire further into the matter.

The question of rates was discussed briefly by Messrs. Davis, McWilliam, Ranson and Kleinstueck.

Dr. McWilliam stated the Canadian Pacific were anxious to make a low rate on shipments of peat; Mr. Ranson stated he shipped by water whenever possible, as much lower rates were obtained; and Mr. Kleinstueck stated that the representatives of the Grand Rapids & Indiana road had come to Kalamazoo to interview him about the rate on peat, and other roads in Michigan were ready to make a low rate.

Mr. Moulton, of Dover, N. H., Vice-President for the New England Section, stated there had been some progress along different lines in this section; that different men in Boston have been studying the questions on other lines than making fuel and have made advancement, and the interest in the peat question had increased very much the last year in New England.

Voted: That a nominating committee be appointed to nominate officers for the ensuing year, and the Chairman appointed the following: Messrs McWilliam, Kleinstueck and Goodrich.

As there was some time available before adjournment for luncheon was necessary, Mr. Ranson read a paper on his operations in Florida.

PEAT UTILIZATION IN FLORIDA.

The author first reviews problems before those interested in making use of peat, and calls attention to the elementary character of the literature of the subject.

The first plant to be erected by him was for fuel-making at Juling-

ton Creek, twenty miles from Jacksonville. It was equipped with a brick-makers' pug mill operated by steam, but because of unfavorable weather and other conditions and inexperience, this did not yield theoretical returns. Later the plant was equipped for making fertilizer filler, but after running for a time with moderate output of a saleable product, the management was changed and in August, 1908, the plant burned, and has not been rebuilt.

In October, 1908, a second fertilizer filler plant was begun, 60 miles farther south, which was completed and turned over to the owners in the spring of 1909. Plans for a third plant for making the same product to be built near Palatka, are now being developed. In this it is expected power will be furnished by a new type of gas producer, the gas being utilized in gas engines.

The bogs thus developed are all wet and undrainable, being located on the St. Johns River and near its level. The methods of digging, air and artificial drying, and preparing the peat for market are described. The paper concludes with a short consideration of the real value of peat for fertilizer use.

(This paper will be published later in this Journal).

He subsequently stated in answer to questions that the peat was dried after partial drying out of doors, in a drier using artificial heat, at a temperature of approximately 130 degrees of heat; that the water evaporated quickly from the top without penetrating the peat; and he had received $5.00 a ton for peat as a fertilizer, which is used extensively in celery raising and for citrus trees.

It was then voted to adjourn until 2 p. m.

Afternoon session assembled at 2:45 P. M.

In the unavoidable absence of Mr. G. F. Dinsmore and Mr. John S. Schumaker, of Boston, their papers were read by Mr. DeGruchy, Editor of the New England Engineer. These papers, Early History in the production of Light, Heat and Power from Peat by Mr. Dinsmore and a written discussion by Mr. Schumaker, described an experimental plant run for some time in Cambridge, Mass., for the purpose of making illuminating gas from peat; Mr. Schumaker discussed the process from the viewpoint of the fuel engineer. (These papers will be printed in full in a later number of the Journal.)

Mr. DeGruchy: It might be interesting to you to know that Mr. Dinsmore's firm, the Dinsmore Power Process Co., is now working on its process of producing light, heat and power with the use of peat. I do not know, nor could I explain the manner in which this is to be done. The company's offices, however, are 141 Milk St. and I am sure that Mr. Dinsmore or any of his collaborators will be very glad to explain the machine that they propose to put out. It is a gas machine or a gas development machine, I don't exactly know what.

Mr. Ranson: We will now listen to No. 10, "The Peat

Trip that Petered Out," passing for the present Nos. 7, 8 and 9 in the expectation that their authors will be with us later.

Mr. Kleinstueck, after explaining that he was not prepared to give a paper on the subject announced and referring to his trip to Mexico, where he had not seen an ounce of peat, read a paper which he had brought along with him in which there was "not one word of peat," which he entitled "Antique Ancient Building in Mexico."

This was a very interesting description of some of the ancient Mexican cities and ruins, and a comparison of these with those of some of the ancient civilizations of the old world, especially Egypt. The paper embodied a wealth of detail and description that made it highly interesting and instructive.

(The paper was withdrawn from the hands of the Editor by the author for use elsewhere and it is not known whether it will be returned or not for future publication.)

In the absence of Mr. J. H. Van Glahn, of Toledo, O., the paper prepared and sent by him to the Secretary was read by the Chairman, Mr. Ranson, as follows:

PEAT MACHINERY AND PRODUCTION OF PEAT.

The process proposed is as follows: (1) The removal of peat from the bog to drainage bins by a specially designed vacuum extracting pump, placed with the boiler for operating it on a float or scow. The peat is to be broken down by a smaller force pump operated on the same scow.

(2) Fuel for the plant and the pumps to be producer gas from peat.

(3) The drained peat is automatically taken from the bins and conveyed to the water extractor by a new type of disintegrator that frees some of the contained water by thoroughly breaking up the cells and fibers of the peat. The water extractor is a novel one, consisting of 24 polished iron rolls, and 13 steel hot plates, all supported in a heavy steel frame. The plates and rolls are to be heated with steam, and are made adjustable, and the temperature can be regulated to any desired degree.

(4) The peat falls from the water extractor with about 16% moisture, into an agitator, which tears up the thin sheet of dry peat into small particles.

(5) By the same machine the peat is conveyed to a rotary drier and deprived of the rest of its water. The drier is specially designed and fully described by the author.

(6) From the drier the peat goes to the tempering machine, which thoroughly reduces it all to a homogeneous mass of fine powder.

(7) The tempered or powdered peat is conveyed to the briquetting press of novel design and construction. which is planned to meet all of the requirements for making peat powder into briquets.

(8) The output of the briquetting press, as designed, is 69 briquets 2⅞ inches square and 10 inches long, per minute, or 45,540 per day, equivalent to about 102 tons of dry peat.

(The full paper will be published in an early number of the Journal.)

Mr. Davis: Mr. President, I will say that Mr. Van Glahn is the mechanical engineer of the Peat Products Co., which was formed in Lima, Ohio, six or eight months ago, that they are building this machinery as stated, and expect to install it at a place in the northwestern part of Indiana. The object of Mr. Van Glahn and his company is to have a continuous process, as you can see from the paper.

Mr. Ranson: If Mr. W. J. Creamer from Bangor is here we will listen to his paper No. 11 on the program, at this time.

Mr. Creamer: I did not expect to be called on at this early time, but I assure you I esteem it an honor to be permitted to meet with the representatives of the peat industry and I also feel that I have an apology to offer to you gentlemen for occupying your time, from the fact that I feel my inability to impart any knowledge and the only excuse that I can offer for being here is that I wish to absorb something from you gentlemen that may help us in our work in Maine. We are in earnest and expect to accomplish much, but you who have had experience in this subject know that there are many disappointments in the business, and, in fact, we might say that up to the present time it has been a series of disappointments. The title of my paper instead of that printed in the program is:

"PRESSED PEAT; THE DOW HYDRAULIC FILTER-PRESS PROCESS."

The Peat Manufacturing Co., of Bangor, Me., has been for some time conducting experiments with a view to producing pressed peat fuel by a specially constructed hydraulic filter press invented and designed by Fred T. Dow, an experienced mechanical and hydraulic engineer.

The object of the process is to expel enough of the contained water, and at the same time produce a firm, hard block that will stand much hard usage without breaking. Instead of attempting to produce a dry or nearly dry fuel by immense pressure, experiments are being conducted to see how moist the peat may be produced and yet hold together to be safely handled.

The company at present does not feel warranted in describing its process in detail nor the machine Mr. Dow is designing of a different type but embracing the same basic principles as that now in use.

(This paper will be printed in full in a later number of the Journal.)

Mr. Ranson: Gentlemen, we now have the pleasure of listening to Prof. Charles A. Davis, who will tell us about the

"PEAT INVESTIGATIONS OF THE U. S. GEOLOGICAL SURVEY."

During the fiscal year ending June 30, 1909, peat investigations were carried on by the U. S. Geological Survey under the following heads:

(1.) Areal work in New York, Massachusetts, New Hampshire, Maine and Michigan, to collect and study material from which to determine the origin, quality and fuel value of the peat beds of parts of those states.

(2.) Co-operative work of similar nature with the State Geological Surveys of Wisconsin, Connecticut and Florida, in determining the extent and value of the peat resources of parts of these states. The samples were collected in accordance with instructions from the U. S. Geological Survey and all chemical and fuel tests were made at its chemical laboratories.

Co-operative agreements have also been made with some of the State Agricultural Experiment Stations to carry on some work on the nitrogen compounds of peat.

(3.) Statistical work has been begun to determine the probable amount of peat available in the country and to keep a record of the production of peat for various purposes.

(4.) Educational. Publications. Peat Deposits of Maine, U. S. G. S. Bul. No. 376, Estimate of the Peat Resources of the United States; Production of Peat in the United States in 1908; Preparation of Other Papers; News Letters for the Newspapers.

(5.) Experimental: A single incomplete gas producer test; drying tests, not yet completed; chemical and fuel analyses.

The practical fuel tests have been almost impossible because of inability to secure peat fuel in any quantity.

(This paper will be published in full in a later number.)

Mr. Ranson: It seems to me we have made a great step in peat investigation by getting the co-operation of the United States Government and the mere fact that the appropriation has been cut down on the fuel investigation should make us take a little more interest to get that appropriation increased. The senator from Florida has taken an interest and has promised me to push the matter and both our Congressmen have been communicated with along this line, and that is the only way I know of that we can get any help. Let us all bring it to the attention of our Congressmen and I have no doubt another year we shall get a large appropriation for this matter.

Following the paper there was an extended discussion, chiefly upon the question of drainage of peat bogs, with explanations of Messrs. Davis, Anrep, Moulton, Ranson and others, also questions in regard to mixing the peat, the advantage if any in dollars and cents and as applied to different sections.

Adjourned at 5:30 P. M.

September 24, 1909.

Re-assembled at 9 A. M.

The Chairman read the following letter from Dr. J. H. Pratt, President of the American Peat Society:

My Dear Mr. Bordollo:

I am very sorry indeed that I can not meet with the society this year, but a combination of circumstances makes it impossible for me to leave at this time.

Please express to all the members my sincere regrets. I trust that

this annual meeting may be the best and most enthusitstic of any we have had, and I believe it will. Our society has prospered, is becoming recognized, and is firmly established, and we have considerable reason to feel very much encouraged for its continued success. Enclosed is my address. Yours sincerely,

JOSEPH HYDE PRATT.

Mr. Ranson: We will now listen to the paper sent by Francis J. Bulask of the Peat Engineering Co., Toledo, O., and written jointly by Mr. Bulask and Mr. Herbert Garnett.

"THE STARTING POINT OF PEAT FUEL UTILIZATION."

The authors open the paper with a brief resume of the methods of drying peat for fuel uses: (a) briquetting; (b) mechanical extraction by pressure; (c) air drying, which they state is the only one successfully used abroad.

The reason for this lies in the nature of the chemical compounds formed in the peat during the partial decay of the plants forming it. The most important of these compounds, pectic acid, is liberated by thorough maceration of the raw peat containing it and permeates the mass. The air oxidizes the pectic acid to another compound termed hornoid, and when blocks of freshly macerated wet peat are laid on the ground this substance forming on the exposed sides and ends contracts as the amount on the outside of the block increases and presses part of the water downward and outward through the still wet under side. The rest of the moisture evaporates into the surrounding air.

With these principles in mind the authors point out that the bulk of the peat fuel used in Europe is macerated by simple, portable machinery, and, after maceration, is either formed into bricks and laid on the ground to dry, or is spread out on the cleared surface of the bog in thin sheets, marked off and left to dry. The process is called the wet process.

Plans are presented for a complete portable peat fuel plant having a capacity of 20 to 25 tons of raw peat hourly, estimated to cost from $8,500 to $10,000, complete. This plant consists (1) of a steel truck mounted on apron wheels and carrying boiler, engine, or electric motor, winch, crane and orange-peel bucket; (2) a smaller truck mounted on broad wheels, attached to the first truck, and carrying the peat machine; (3) a "field press" for spreading and dividing the machined peat on the drying ground.

In operation the three parts travel over the bog at a fixed rate, the engineer steering while the man at the crane digs a channel or ditch along the side of the forward car, and drops the material as fast as excavated into the hopper of the machine, which reduces it to a homogeneous pulp, which in turn is spread and marked by the field press.

(This paper will be published in full in a later number of the Journal.)

Dr. Mighill questioned the Chairman as to the cause of the oxydization of pectic acid as referred to in the paper and a short discussion followed. Mr. Davis replied as follows:

These problems in organic chemistry are among the very difficult things we run up against. I don't believe anyone

knows whether pectic acid or some other acid is the chief cementing substance in all wet peat. It is quite probable one acid is present in one bog and some other in another. In many of the states of this country the peat is not acid when taken out but becomes acid when exposed to the air. Sometimes again it is acid to the taste, as it lies in the bog.

Question: Would the existence of that acid in a bog, that is where strong enough to be tasted, or to be noticed on litmus paper, have any action at all on the fuel?

Mr. Davis: No, I would not consider that it would. This is simply a guess because I don't know what the acid is, but these organic acids are all easily decomposed.

I fancy from what I have seen that there are a number of acids which are present in different bogs, one may have one acid abundant and another will have another. The weight of authority seems to be in favor of pectic acid being one of the important acids. There are a whole lot of acids which have been isolated at different times. The more competent men work upon them the more they find it possible to separate them into apparently distinct substances. The amount due to chemical manipulation is a question.

Dr. Mighill cited as an illustration the loss of a crowbar in his peat bog that remained in the water for a year and when taken out was as bright as new iron, the surface also showing that it had been attacked by the acid, and asked if in bogs of that character there would not be more or less trouble caused by the action of the acid on the machinery used in operating. A short discussion followed as to this effect being noticed in other bogs, but the question was not answered.

Mr. Ranson: I will now ask for a report of the Auditing Committee.

Dr. McWilliam: For the Auditing Committee I might say that we found our task much greater and more complicated than we had anticipated and while we have audited the Treasurer's books and found them correct, we have not yet audited the Journal books and we ask for an extension until this afternoon to make our report. Further time granted.

Mr. Ranson: We will now hear the report of the Nominating Committee.

The Nominating Committee recommends the following names for officers:

President: Dr. Eugene Haanel, Director, Mines Branch, Department of Mines, Ottawa.

Vice Presidents: John N. Hoff, Eastern States Section.
Carl Kleinstueck, Great Lakes & Mississippi Valley Section.

Robert Ranson, Southern States Section.
C. V. Imeson, Pacific States Section.
Dr. J. McWilliam, Canada Section.
Dr. Chas. T. McKenna, New York Section.
O. E. Moulton, New England Section.
Julius Bordollo, Secretary-Treasurer.
Prof. Chas. A. Davis, Editor-in-Chief.
Francis J. Bulask, Managing Editor.

There being no other nominations, the report of the Nominating Committee was accepted as a whole and it was

Voted: That the Secretary be instructed to cast one vote for the names presented by the Nominating Committee.

In accordance with the vote of the Convention the Secretary cast one vote and the officers as nominated were declared duly elected for the ensuing year.

Mr. Ranson: It seems, gentlemen, that the time is ripe for me to speak just a word in regard to these officers. I know they have all taken a great interest in the Society, but the very existence of our Society has depended upon the interest of our Secretary and Treasurer. A great many of us know that and some of us do not know it. As the Society at this time is not very strong financially—not strong enough to vote a large salary to the man who holds that position—I certainly feel like calling for a rising vote of thanks to Mr. Bordollo for his services during the past year.

Mr. Kleinstueck: I certainly cannot say any more to show my endorsement than by standing up. We certainly can never expect to get a better Secretary and Treasurer than Mr. Bordollo who is the life and soul of the Society.

On motion duly made and seconded, it was

Voted: That we express our appreciation of Mr. Bordollo's services by a rising vote of thanks.

Mr. Bordollo: I thank you very much. I do not consider any vote necessary because it is a work of love.

Mr. Ranson: In my paper I expressed my appreciation of Mr. Charles A. Davis. He has been a wonderful help to me. Personally I have had not only aid from a geologic and botanic standpoint from him, but he has given me a wonderful amount of help in the commercial and manufacturing side of the business. I have never written a letter that he has not fully replied to and very often gone very much out of his way to other departments to get the information I wanted. I haven't a question but that he has done the same thing for anybody else who has called upon him. I am only too glad to repeat what I said yesterday as to our very great appreciation of Professor Davis. I could not say more if I were to talk for an hour. I would

to hear from any man with a view to thanking Professor Davis for his efforts.

Dr. McWilliam: Mr. Chairman: I believe I had the pleasure to move such a vote of thanks at our last meeting in Toledo. I would further move a vote of thanks to Professor Davis for his unselfish efforts in behalf of this Society.

Mr. President, ours is a very much more honorable attempt at increasing the assets, the financial assets, of the country than the first glance would show. In this attempt that we are making I have frequently said in Canada to scientists and members of the Government that I would rather beat in the game of "peat," I would rather win and establish a plant that could sell peat at a profit than be Premier of the Dominion of Canada, or President of the United States. (Applause.) I have also said and I believe it is true, and I have paid for my information and knowledge in my own money, that the taking of a peat bog and making it into fuel that is worth $4 a ton at the bog and will compare with coal in our country,—to make that pay is a more difficult question, a more difficult undertaking than was the invention of wireless telegraphy and a great deal more use when you get it done than wireless telegraphy was. In view of those statements, if half true, and I believe they are wholly true, Professor Davis' efforts, together with Mr. Bordollo's, are directed to a very high cause, and if we succeed and we are bound to succeed in the end, we shall be greatly indebted to Professor Davis for his having held the Society together, in having honored it with his culture and fine scholarship and great executive ability. We all feel honored in following Professor Davis. We know when we have finished reading his reports that we have learned something. His reply this morning was characteristic of the scholar and gentleman. He said he didn't know and the reason he didn't know was because nobody knew. It is all vague talk. His was the answer of the scholar and was practical and useful.

I therefore move a very hearty vote of thanks to Professor Davis for his unselfish labors and for honoring our Society by his presence and for meeting with and holding us together with his splendid executive ability. (Applause.)

Motion seconded and carried unanimously by rising vote.

Mr. Davis: I want to express my hearty appreciation of this honor which you have shown me and also to say that while I do not consider that I merit all this, I am excedingly pleased to have your expression of regard and especially the regard for my work. I have to take the attitude many times which the old farmer is said to have taken who had established a reputation of guessing the dressed weight of animals from inspecting the live animal. He had acquired quite a reputation

for being able to tell how much a hog would weigh dressed by looking at it alive. He had a very large hog of his own. The neighbors had tried and tried to get him to guess the weight of this animal, without success. Finally it was killed and dressed and one of the neighbors asked him what it weighed. He said, "Well, it didn't weigh as much as I thought it would, and I didn't think it would either." In my own work I have to say many times that I would like to be shown, but I want you to feel always that my attitude is that of the endorser and the friend of every effort that is legitimate in attempting to utilize in any way peat for commercial uses. At the outset of my investigation I cared most for the scientific end of it, but I am getting to care more and more for the possibilities of the commercial end and the great hope that I now have is that we shall soon see, and I am very confident that we will see it, shortly, a commercially successful operating plant for preparing peat fuel for market. It will not be very long I am sure.

Voted: That the address of Dr. McWilliam be engrossed and a copy presented to Professor Davis, and to Mrs. Davis.

Voted: That the next session of the Society be held in Ottawa, Canada, and that the exact date be left to the Executive Committee.

Mr. Ranson: The next number is "Peat Briquetting," by Mr. O. E. Moulton.

PEAT BRIQUETTING.

Mr. Moulton: Mr. President and Gentlemen: I thank you for your greeting. I wish to say in preface that I approach the subject of Briquetting with more or less timidity. I am perfectly well aware of its unpopularity all over the world. I am perfectly well aware that in America it has been tried on several occasions without success and that the concensus of opinion of those who come to us from foreign lands is decidedly against it. Everybody tells us, as you know, if you want to make peat fuel, mix up your peat in the pugging machine, spread it out on the surface of the bog and after 14 or 15 days gather it up and stack it and sell it. That is all right, gentlemen; peat makes a good fuel that way. That method of making peat fuel didn't appeal to me when I began to study this question some five years ago. If I must make peat fuel that way I shall quit the business. Mr. President, you will pardon me if I speak plainly. It is my habit. I have never been known to call a spade anything else than by its proper name. Therefore, if my remarks are a little brusque I bespeak your forbearance for them.

(This paper was withdrawn for revision and will be published in full later in this Journal.)

In this connection I wish to say that so far as I have been able to learn, lignite is almost universally treated to the briquetting process in Germany. That is evidenced by the vast number of plants, their output and the amount of money invested in the business. Peat is in a certain stage of the same material, newer in its geological formation, containing more water. If it is sensible to briquette lignite why is it not sensible to briquette peat? Again, gentlemen, I venture the remark, knowing something of the taste and requirements of New England people, that offered the two peats, side by side, at the same price, 90 per cent. of the people would buy the briquettes in place of that made by the older or the wet process. Why? Because it looks better. I will prove it by yourselves. Anyone of you going into an apple orchard to pick up apples will take the best looking ones although they all taste alike; it is instinct, you all know. I perhaps may be expected to tell you a little of my own experience. I had much rather be excused from doing this. When I first took up the question of briquetting I studied both sides for a year before determining what I would turn my attention to. I then turned it to briquetting for several reasons, and prominent among those reasons I will admit that this was one; everybody else had failed at it and given it up and that was sufficient spur for me to take it up. You say there is no business in that. Gentlemen, there is business in briquetting peat fuel; there is business in peat fuel after it is briquetted, and that will be proved to you within a very short time. In fact, I believe Dr. McWilliam has proven it to you. You ask if he has made any money. No, nor has anybody else made any money in the peat business. We have yet our way to learn. In some respects we are all experimenters. Mr. Anrep comes over here from Sweden with a knowledge which would be of benefit to us. I understand he is to speak to us. I shall listen with a good deal of interest. Whatever view of this question he may take will make no difference to me. He has been brought up in the business; his father was in it for forty years or more. He should speak with authority but there are few of us in America that can do so. Therefore, let us be patient with one another. While I am perhaps the only man in New England who stands for briquetting there is not one of you who can say I am absolutely wrong from your own knowledge. There is not one of you who can say that in two years' time I may not show you a better product at less price than you can make the other way. I do not want to be understood as being captious in this matter. I told you I should speak brusquely. I believe in the possibility of briquetting peat fuel and selling it at 100 per cent. profit. If I did not believe that, I should not be talking to you here today, and until I have greater light and

have the experience of more men than I have now been able to read I shall certainly continue in that way of thinking.

Mr. Ranson: We will now listen to Professor Davis.

CHEMICAL PRODUCTS FROM PEAT.

The author reviews the early attempts at gasifying peat, and the efforts of chemists in the middle of the nineteenth century to make sulphate of ammonia, acetate of lime, pyroxylic spirit (wood alchool), naptha, illuminating oils, and paraffin, and shows that the same materials are now successfully made as by-products in the manufacture of peat coke. But it was also shown that the cost of installation was very high and the recovery of the chemical products was only successful when large amounts of peat were coked. Small recovery plants do not pay, even when very carefully managed.

Four different processes worked out in Europe and brought to commercial stages, either actually or about to be tried, were discussed. These are (1) the Ziegler process for making peat coke and chemical by-products; (2) the recovery of chemical by-products from gas-producers in which dry peat is gasified as developed by Dr. Ziegler; (3) the recovery of ammonium sulphate from gas-producers in which moist or wet peat is used, by the Frank and Caro process; (4) the manufacture of ammonium sulphate, acetic acid and other chemical substances on a commercial scale by the combustion of peat containing 75% water. This is the invention of Dr. Woltereck and is a process of chemical manufacture pure and simply, only ash and stack gases remaining besides the chemical products.

(This paper will be published in full in this Journal.)

Mr. Ranson: The next number will be the paper of Dr. McWilliam.

THE MILNE PROCESS FOR MAKING PEAT FUEL.

By this process, the peat is gathered in the form of dust by suction from the cleared, drained and harrowed surface of the bog, into a car running on a track laid on the surface of the bog. The peat in from two to six hours dries in a thin layer on the surface to 25 to 30% moisture. After gathering it is further dried to below 15% in a drier and then briquetted.

The author stated that since 1907 work at his plant had been largely experimental. That after firing with peat dust in 1908 it was given up for the present because of difficulties in drying and grinding the peat. The plan seems feasible, but needs improved machinery for preparing the dust, to be successful.

The old rotary drier, used for four years, having proved unsatisfactory, a new one, described in the next paper, has been designed and built at the plant.

The commercial success of the process seems to be assured for the following reasons.

(1.) The method of collection is a success; the peat powder can be put into the storehouse at a cost in wages not more than 25 cents per ton, and of fuel of from 10 cents to 15 cents per ton.

(2.) The cost of briquetting, if the press and collector are running simultaneously, is very small, but if the press is run alone the cost for wages is 50 to 60 cents and of fuel 10 cents per ton of product. The drying is done by waste heat.

(3.) The fuel sells readily at the factory at $4.00 per ton. The present plant has an estimated capacity of 15 tons of briquettes per day.

The writer claims that, while not the only way to make peat fuel, nor the best way, it will pay, and ought to be still further developed and improved; that it makes a clean, hard, transportable and attractive product, and that it offers a solution to a very difficult problem.

THE MALLOCK PEAT DRIER.

Designed to dry peat dust collected by the Milne process from 30% moisture down to 8 to 15%:

It consists of a series of pans 20 feet long by 3½ feet wide and 1½ inches deep, of heavy iron plates riveted together, so as to hold steam at 100 pounds pressure. A system of rakes moves the peat forward. Between the pans are 2-inch steam pipes, and the whole drier is enclosed in a heavy brick wall. The heat is derived from the exhaust steam from the engine and from the stack gases. Live steam from the boilers can be turned in if needed. The stack gases are turned through the drier by an exhaust fan and a system of screens prevents the passage of sparks.

Trial runs have been very satisfactory, the points in its favor being its use of heat from exhaust steam and stack gases; its uniform and proper heating of the peat without superheating it; its simplicity and ease of operation; its freedom from danger of catching fire; the fact that it delivers the peat to the press at the desirable temperature of from 170 to 200 degrees.

(These papers will be published in full in a later number of this Journal.)

Adjourned to 2 P. M.

When the Society re-assembled the Auditing Committee reported that it had examined the accounts of the Journal and found everything correct and in order.

Voted: That the report of the Auditing Committee be accepted.

Voted: That a report of the transactions of this session be published in the Journal under the direction of Professor Davis.

Voted: That the thanks of the Society be tendered the Managing Editor for the high financial showing of the Journal.

Voted: That the thanks of the American Peat Society be embodied in writing and transmitted to the authorities of the Massachusetts Institute of Technology who gave the use of the building for the present session.

Mr. Ranson: We are honored by having with us Prof. Haskins who will give us a paper at this time.

Prof. Haskins: Mr. Chairman, Gentlemen of the American Peat Society: I propose to make my remarks short this afternoon. It is my experience that at a convention of this sort

people are apt to make discussions too long and they become burdensome. I shall not, however, condense my paper as much as a story I read a short time ago, a story in four chapters that only consisted of four words, a romance by the way, describing the ordinary love scene, the courtship, the marriage and wedding bells, orange blossoms, etc., and finally the patter of little feet. The story in short is as follows: Chapter 1, He; Chapter 2, She; Chapter 3, They; Chapter 4, It.

As I say, I shall make my remarks rather short and allow perhaps for a little discussion after I have finished.

THE UTILIZATION OF PEAT AS A SOURCE OF NITROGEN FOR PLANT FOOD.

The only constituent in peat in sufficient quantity to be considered worth while as plant food is its nitrogen. The other substances that are present are too cheap in better forms than are found in the peat to be of importance.

Nitrogen is the most costly element of plant food, varying in price from 18 to 22 cents per pound, according to the ease with which it becomes available to growing plants. The better grades of peat often show as high as 2.5 to over 3% nitrogen. Peat has fertilizing value besides its nitrogen content, because it adds humus or similar organic substances to the soil, and these improve its physical condition.

But little work has been done by scientific agriculturists to show the relative value of peat as a fertilizer. Some analyses have been made to show the better grades of peat to have a nitrogen availability of 21.4% as compared with blood and fish, with nitrogen availibility of 65% or over, but this is only comparative; these figures do not show the true amount of nitrogen which is available; this can only be determined by vegetation experiments.

The Agricultural Department of the Massachusetts Experiment Station has for two years been carrying on such experiments by growing millet in pots under conditions that can be absolutely controlled in every detail. The experiments include all well known sources of nitrogen, hence have great comparative value.

The result of these experiments leads to the conclusion that there is no question but what the nitrogen in dried peat has a much lower availability than does the nitrogen in the high-grade animal and vegetable ammoniates, and for this reason its use as a source of nitrogen in mixed fertilizers must be excluded in order to comply with many state laws.

The value of peat as a dryer, an absorbent and source of humus, and to improve the mechanical condition of fertilizer mixtures, is pointed out.

(The complete paper, including the details of the experiments, will be printed in the Journal.)

During the reading of the paper photographs were distributed illustrating the experiments made by Professor Haskins, to which he had referred.

After the paper a short discussion was had on the subject

of the millet plants which were grown in different kinds of soil at the experiment station and as to the value of peat in the manufacture of fertilizer.

Mr. Ranson: The Gibbs Gas Engine Company have written a letter to us through their President. (This was read.)

Mr. Heseltine: I believe we have a representative of these people present and I should like to hear from him at this time.

Mr. Ranson: We will be very glad to hear from Mr. Ogburn.

Mr. Ogburn: I am connected with the Gibbs Gas Engine Company but my own activities are more on the side of the gas engine than on the side of the producer. However, I have looked into it considerably and know something of the producer invented by Mr. Akerlund of Sweden and this invention will burn bituminous coal without a tar extractor, so far as I know the only one on the market that will do that. Experiments were made this summer in the producer with peat and those experiments were successful so far as tried out. The producer was run on bituminous coal and was run on peat and there was practically no difference noted as to the efficiency secured in the result. I do not know the particulars or the percentage but I thought it might be of considerable interest to this Society of men interested in producing and selling peat to know that this producer, so far as the tests have gone, has operated successfully.

Upon motion of Mr. Kleinstueck, a discussion of the Zeigler process which had been mentioned in the paper of Professor Davis was had which was participated in by Mr. Kleinstueck, Dr. Zwingenberger and Mr. Anrep, as follows:

Mr. Kleinstueck: From the paper of Prof. Davis on the manufacture of chemical products from peat, his remarks on the Ziegler Process were most interesting ones to me. When, in 1902, I was looking up the European peat industry, I visited the Ziegler Plant at Oldenburg. I remember well the kind advice I got from the superintendent on the drying of peat. Since that time I have closely watched the progress of the Ziegler process, as I have no doubt a great development along this line will take place in this country. But in recent times rumors have reached my ears that the concern holding the Ziegler patents is not square, and as it is the first duty of our organization to suppress any fraud, wherever it may come from, I take the liberty to ask Dr. Zwingenberger, formerly connected with this concern, whether or not he is willing to tell us something about that.

Dr. Zwingenberger: In answer to Mr. Kleinstueck, I am at all times ready to discuss this matter, but I can, of course, give only the facts which I personally learned during my con-

nection with the Oberbayrische Kokswerke and Fabrik Chemischer Produkte at Muenchen-Beuerberg.

I became connected with this firm in the fall of 1905. In the spring of 1906 Mr. Wallach, president of the board of directors (Aufsichts-rat), made to me the proposition to go to the United States to close up a deal on which the firm had been working for some time. Owing to the way in which the situation was presented to me and on certain promises, I consented to do so on my own risk. This latter point is important in my relations to this firm and to the character of its actions. I found, pretty soon after arriving in the United States, that the deal of the Kokswerke could not be put through. I entered, therefore, a position in New York and was willing to discontinue my work in behalf of the Kokswerke when, about New Year, 1907, they declared they would have to pass a dividend for 1906-07. In the meantime I became connected with some Boston people interested in the Ziegler Process; the matter went on slowly, but my interest was kept alive by favorable news from the Kokswerke about works to be erected in England, etc. I base my answer to Mr. Kleinstueck on the following facts, for which I have proof in black and white:

(1). I received a letter, signed "Dr. Kaiser," dated May 15th, 1907, stating in regard to business: The Beuerberg Works are now doing very well.

(2). On December 14th, 1907, I asked the Kokswerke positively for detailed information about their business. Answer: Business is good, products are readily sold at good prices.

(3). I submitted to the Kokswerke in February, '08, an original letter by Mr. Kleinstueck, stating that he was warned by a secretary of one of the European peat societies to invest no money in the Ziegler Process, the same being a "dismal failure." Answer from the Kokswerke, March 7th, 1908: Our business is all right. Secretaries of the peat societies not competent men, don't know anything about technical use of peat, as they are more devoted to agricultural part.

Owing to my personal acquaintance with some of the leading men, I had no distrust in their word, but the tone and the boyish conduct of business demonstrated in their letters disappointed me very much and induced me to drop them, and so I returned from Boston to New York to go into business for myself. On September 25th, 1908, my Boston friends asked me to come over to have a meeting with Mr. Burrage, the well known copper magnate. I had already sent, in the spring of 1907, to Mr. Burrage an article on the Ziegler Process. Though Mr. Burrage apparently took no interest in the matter, he had the Ziegler plants, and especially that at Beuerberg, watched by some experts in Germany. According to their report, Mr. Bur-

rage put his opinion on the Kokswerke in about the same words as Mr. Kleinstueck; in order to give the Kokswerke a chance to prove their claims, we formulated certain questions on all the Ziegler coke plants. The Kokswerke people, as strict business men, could only answer either "yes" or "no." I submitted the questions with a most detailed report on the affair directly to Mr. Karl Kallach-Muenchen, as the Beuerberg management was considered incompetent.

Mr. Karl Wallach states on December 19th, 1908:

I do not know anything about the Ziegler Plants at Oldenburg and Redkino. The Beuerberg Plant is "at present working with loss," but we see now our way to success. The Beuerberg managers are told to give you a detailed report, "if they can, and want to." If you and the Americans insist on dividends as the deciding point for the sale of the patents, there is no hope for success at present.

The Beuerberg answer from December 20th, 1908, was, as stated, privately outlined by Dr. Kaiser, but signed by Mr. Ziegler. The answer was a masterpiece of tame and evasive arguments, consisting of lamentations on labor trouble and bad weather. Neither of the two letters could be considered in any way as an answer to the questions asked. From private parties I learned the real facts on December 11th, 1908, for in the Berlin paper, "Der Tag," the Kokswerke were severely criticized for their attempts to conceal the truth about their standing and the way the firm complied with the German law on publication of annual reports by stock companies. This paper states, on November 25th, 1908:

(1). On April 1st, 1907, the Kokswerke had a loss of $50,000.

(2). On April 1st, 1908, the Kokswerke had to show up another loss of $50,000, making it altogether in two years of operation a loss of $100,000, on a capital stock of $200,000.

How can the parties responsible for the actions of the Kokswerke justify these facts with their statements given above?

With those statements above, I hope I have answered Mr. Kleinstueck's question; the limited time does not allow me to go much into the details, but I think any business man, identifying his personal honor with that of his business reputation, may decide for himself on the standard of business morals arriving at such a state of affairs.

Is the Ziegler Process any good?

The Ziegler Process is in successful operation for twelve years at Oldenburg. The favorable report of the Prussian Government's Commission, after a six weeks' investigation by three men of the best technical experience and absolute independence

from any business connection, was entirely borne out by the later results. This report cuts out any unfavorable opinion on the process based on an accidental one day's inspection. The plant at Redkino has burned down and is going to be built up again by Mr. Ziegler, who now lives in Moscow.

Beuerberg, though technically best equipped, was put on a bad track from the very start. Selfish interests played their part right from the beginning; besides the technical experience of Mr. Ziegler, there was not much business experience in the management, owing to the youth of the men, thus rendering the situation so much the worse.

It seems to me to be positively sure that Mr. Ziegler had, to say the least, in the whole scheme and that he was only considered in certain moments when he better had backed up.

Following selfishly personal ambitious intentions, gross neglect of duty, lack of initiative to take proper steps because the situation was not clearly seen, cowardice to face the music in the moment the crisis had created the rumors which induced Mr. Kleinstueck to ask his question.

Dr. McWilliam (presiding): One of my reasons for coming to Boston was to hear from Mr. Heseltine of Detroit.

WHAT I HAVE ACCOMPLISHED IN THE MANUFACTURE OF PEAT FUEL.

The author informally gave a brief account of his early experiments in preparing peat for fuel, beginning six years ago, and recounted, step by step, his advances until he produced after many trials the simple and efficient machine of which he showed pictures.

This machine weighs 1,260 pounds and has a capacity of 1,000 pounds of wet peat per minute. The machine makes the peat fuel by the wet process, and this season about 1,500 tons of peat fuel, with about 20 per cent. moisture, have been produced in a run of 61 days of 10 hours each. The cost of production was $1.40 f. o. b. cars, a two-mile haul from the factory to the railroad materially adding to the actual cost of production.

The machine will be improved during the winter, as the result of its use this summer, by the addition of automatic devices for delivering the peat to the machine and for removing it to the drying grounds, where it is spread in sheets.

While the results were the same whether placed on the ground or on wooden platforms, boards were favored because a saving of 10 cents per ton and of three days in time of exposure could be made by their use. The platforms found best were made in sections 8 feet by 4 feet, the boards used being 3 inches wide. While drying is going on, up to the fifth day, the peat is covered with canvas during rain, and after the third day, at night. The average time required for drying on platforms was seven days, and on the ground ten days, when the moisture content was about 25%.

The Grand Trunk railroad had made a tariff based on the same rate

as for soft coal with a minimum weight of 40,000 pounds, instead of 60,000 pounds for soft coal.

The cost of production this year can be materially lessened: (1) By automatic attachments already mentioned. (2) By increasing the number of units so that the output will be larger for the same cost of supervision and management. Those using the product have been much pleased with it and the demand for it has been excellent. The part of the bog not being excavated is, to some extent, used for farming operations, as it is well drained.

The author, from his experience, declares that "we have got to go to the wet process of manufacturing peat commercially," and ends as follows:

"I think, gentlemen, it behooves us as members of this Society, to have only one view, that is, to give the world a commercial peat fuel; to turn all our thoughts and attention along this line that has been in the past the most successful, and lay our foundation, and from that keep on building and improving."

(This paper will be published in full in a later number of the Journal.)

Mr. Davis: Mr. Chairman, I want to make a few remarks regarding Mr. Heseltine's plant. I visited it in July. It was extremely interesting to me, to see this small plant doing so much and with relatively such a small working force. It was a very interesting demonstration of the possibility of producing a sufficient amount of good fuel by a simple process, simple machinery and at a small cost. It certainly is worth while to consider the possibilities of this plant. The outfit was simple in every way and was doing good work, as the results show.

I have felt for some time that the more simple the plant and the less it cost to put it into actual operation, the more certain it was to be commercially successful. The simplicity of this plant commended itself to me, and for this reason I emphasize that feature.

Mr. Heseltine stated that he would be glad to see any of the members of the Society at his plant, located at Bancroft, Mich., and stated further his reasons for not presenting a more formal paper. He also stated that while he had not yet notified Professor Davis what he would do, he had decided to let him have at least two carloads of peat fuel for the purpose of experimental work by the United States Geological Survey at Pittsburg, and had gone so far as to secure a special rate for shipping which he had secured only two days before leaving; he would promise two carloads and might be able to send three, which material would cost the government nothing.

Mr. Davis: That leads me to bring up one matter which I have had in mind many times to lay before the Society. It seems to me that if the members of this Society, as a society could contribute something to the advancement of our knowledge of the properties of peat if in no other way than by paying somebody who has it, for even a single carload of peat, at whatever price they asked, so that the Government tests could be

made on a sufficiently large scale to give definite results it would be a fine thing. It we could contribute $100 to peat experiments to be conducted under Government supervision, it would be a contribution that would more than pay, in the fact that it would give us some definite knowledge about things we do not definitely know. I bring it before you only as a suggestion. If we could do it through personal contribution or in some other way to help defray the expenses, it would mean a whole lot to the Society and its members as individuals.

Mr. Ranson: It has been suggested that we would like to hear from Mr. Anrep in regard to his machine or the machine his father invented.

Mr. Anrep: I have great pleasure in being with you and at the same time to be a delegate of the Canadian Government. I would like to give to you some valuable information which has been developed by the Government, but as the Government has requested that I should not say too much about peat because they are working to prepare a plant for commercial use, and it was not my intention to give a paper, I shall have to refrain at this time. Of course I can show you on the board how we are laying out the plant and the extent and how the peat is manufactured. Here the speaker went to the blackboard and by diagrams showed the plan of draining the bog that was to be used for experimental work, and indicated the position of the plant and other details. He also spoke on the principles of draining peat bogs.

Mr. Ranson: There is a paper here which I am sure we should all be interested to hear from our President, Dr. Pratt, who though unable to be present, has sent an address to remind us of his continued interest.

PRES. PRATT'S ADDRESS.

The object of the American Peat Society is to advance the general knowledge regarding the utilization of peat for all purposes to which it is adapted, and to give accurate information regarding its occurrence and value.

Before the Society was established two years ago it was difficult to obtain accurate information regarding the peat industry in this country, the location of peat deposits, the value and uses of peat or regarding the literature of peat. Since its organization, on Oct. 23, 1907, and the publication of its Journal, there has been a most decided change in these conditions, and now the general status of the peat industry is kept permanently before the people, and it is possible to obtain through the Journal of the Society a comprehensive idea of the industries based upon peat, the increase in the demand for peat products and to obtain a digest of peat literature, published not only in this country but abroad.

The three uses of peat which should be most developed in the United States are: (1) for fertilizer purposes; (2) for fuel; (3) for stable

litter. These can and doubtless will be developed to a large extent and will become commercially important industries. The reasons for this belief are as follows.

Peat for fertilizing purposes should not be used directly for its 2 to 3 per cent. of combined nitrogen, which is largely unavailable for plant food in the raw peat, but after composting in the barn yard it is excellent.

Powdered peat for filler for artificial fertilizers is not an adulterant, but is the best of many substances, some of which, like graphite and coal dust, are entirely valueless, used to give bulk, as it adds humus to the soil, while its nitrogen ultimately becomes available. Powdered peat is also sold by itself as a fertilizer to greenhouses.

Peat as Fuel: But little advance has been made in the past two years, except in the study and experiments made in the use of peat for fuel purposes. The peat wherever used has been liked and possesses many desirable properties that insure its popularity, if it can be had at a price comparable with coal. The five plants operated in 1908 produced about 900 tons of fuel. "It seems to me that many peat deposits are so located in near proximity to towns that it would be possible and practicable to erect an electric plant at the bog, using the peat as the fuel and converting it into electric current which would be transmitted to the nearby towns. The peat could be used directly as a fuel or for the production of gas in a gas producer."

Peat as litter and absorbent: The peat best adapted for this purpose is the mossy, fibrous variety. The material is much used in Europe and very little in the United States. As a litter for bedding purposes in stables, espcially in cities, and in dairy barns, its deodorizing and absorbent properties make it especially desirable, and it should have a larger use.

The production of peat in 1908 is then summarized and also the more important peat papers published during the year, most important of which in its influence is placed the Journal of the American Peat Society.

(This paper will be published in full in a later number of this Journal.)

Dr. McWilliam at the request of Mr. Ranson again took the chair.

Mr. Ranson: I find it absolutely necessary for me to take the Fall River Line boat at 6 o'clock and I am going to ask you to excuse me from the temporary chairmanship. I thank you very much for the honor you have shown me and I am thankful that I have not had any very intricate problems to decide. In wishing you goodbye, I want you all to come to Florida, but I want you to come one at a time. I really would like to have any and all of you visit our plant. I would be glad to show you what I am doing and see that you have a good time. Gentlemen, I thank you.

Voted: To extend a rising vote of thanks to our presiding officer for the past two days, Mr. Ranson.

The Secretary then read by title the following papers, whose authors were not present, but had sent copies of their articles:

"CONTINUOUS VACUUM FILTERS AS DEWATERERS."

Robert Schorr, San Francisco, Cal.

One of the most serious problems met in many manufacturing undertakings is the elimination of large quantities of water or other liquids at a reasonable cost.

It is of first importance to have the process entirely automatic or as nearly so as conditions will permit without impairing the quality of the final product. For this reason most of the intermittent acting devices have found only a comparatively limited field and in many cases have been tried and discarded again. The labor cost is high, and where waste furnace gases or cheap fuel are available the continuous process in the drier will be preferable.

For mere de-watering, there is nothing to excel continuous vacuum filters, which may be grouped under six types, which are described as to essentials, with references to patents and descriptions in various periodicals. The filtering media used and the approximate capacity per square foot considered. For some types of filters it will be safe to assume, as a preliminary, from two to five tons of water withdrawn per square foot in 24 hours. The degree of dilution has considerable influence on the output, and if the solid material is very spongy or fibrous, poor results will be obtained unless the fibers are thoroughly broken up by disintegration. This is the case with many peat propositions, and as the problem of cheaply de-watering is of great importance with that substance, the author discusses the probable economic results that may be expected by employing continuous filtering machines for this purpose, and full estimates of the costs and results of the operation of a possible commercial plant are given, the reduction of pulped peat from 90% to 60% water being accomplished at a cost of 2.7c for filtering, or 6.5c per ton of dry peat substance. Such peat could be dried farther by using waste heat from boilers, distilling retorts or gas-producers could be used to good advantage.

This filtering method is many times cheaper than air-drying where hand labor is used and drying can be carried on throughout the year, while draining the bog is unnecessary.

(This paper will be printed in full in a later issue of this Journal.)

THE USE OF PEAT AS A FUEL IN GAS PRODUCERS.

D. T. Randall, Boston, Mass.

The gas-producer is an apparatus for converting solid fuels into a gaseous state. It is usually built of heavy sheets of steel riveted and calked to form a gas-tight. cylindrical shell, which is lined with firebrick to protect it from the high temperature resulting from the combustion of the fuel.

The principles of the construction of the up-draft and down-draft producers are given in some detail, and it is shown that the design of a successful gas-producer is not as simple as it may appear from an inspection of the apparatus; it seems necessary to arrive at the proportions for each diameter of producer by numerous experiments. One or two

successful gas-producers have been put on the market that embody the leading features of both up-draft and down-draft types.

After a concise statement of the way in which different kinds of gas-producers are operated and the principles of the chemical changes involved in the combustion of the fuel and the formation of producer gas, the scrubbing apparatus is described and its use indicated.

The action of moist and wet fuels in the gas producer is discussed, and while no exact limits are possible, it seems probable that fuels would be most satisfactory which contain less than 30% of moisture, and peat with this amount is a satisfactory fuel for either type of gas-producer and gives practically as good efficiency as bituminous coal when the heating values of each fuel are compared.

After considering the amount of preparation to be given the peat, instances of its use in gas-producers, both in Europe and the United States, are given, including an account of the tests made at the U. S. Geological Survey testing plants, in which the thermal value of the gas obtained and the amount of fuel used per commercially available horse-power are given.

The conclusion is given that from these tests it may be inferred that for a fair quality of peat, power may be generated without difficulty in a gas-producer plant, and the cost of power will be governed very largely by the quality of the peat and the cost of digging and drying it to a condition suitable for use in the producer.

(This paper will be published in full in this Journal.)

SOME OBSERVATIONS MADE DURING FIVE YEARS STUDY OF PEAT.

E. Curtis McKenney, Saugus, Mass.

The paper opens with general statements regarding the past attempts at peat utilization, and of general principles. The work of the pioneers in peat development in New England is reviewed, and an account of the author's own early interest and trials at peat fuel making. Attention is called to the type of men who, in the author's judgment. will bring about a successful conclusion to the present uncertain state of peat fuel making, and the six years' successful manufacture of peat fuel in the vicinity of Boston by the late Thomas H. Leavitt, more than forty years ago, is cited. Mr. Leavitt's book, "Facts About Peat," is also noticed.

The radical departure from established practice by the peat enterprise at Orlando, Florida, where peat was, for the first time in the United States, macerated and spread in heaps on the ground to dry, is commented upon.

The use of peat in the gas-producer as a source of power gas, especially in New England, is considered the best way of utilizing it, and experiments by the writer show that peat containing 30% to 40% of moisture can be used in a gas-producer; also that to form the peat into bricks is a needless waste of time and money. Nor is it always necessary to disintegrate the peat before drying, as the author found he could spread the freshly cut peat on the surface of the bog to a depth of six inches, and, after drying for ten days, it cracked up into irregular blocks which, after drying to 30% moisture, were put into a storehouse and dried there into a firm, hard fuel that had been used successfully in open fireplaces and stoves. It has also been tested under a steam boiler and

in a gas-producer with good results. Comparative drying tests of the unmachined and machined peat are reported. Some fifty tons of peat fuel have been made this season as a cost of 75 cents per ton. It is pointed out that it is not wise to use all parts of the bog for the same kind of fuel. The upper layers may be made into litter profitably.

Above all, the writer states, he has learned that an expensive and elaborate peat plant is not always essential to success, and that to succeed in the peat fuel industry one must study not only the successful producer of peat, but those who have failed, and profit by their mistakes.

(This paper will be published later in the Journal.)

PEAT COKE PRODUCTION.

W. L. Shepard, Elmwood, Conn.

A short history of a line of investigation and experimental production of (1) briquettes, both peat in combination with other substances and alone; (2) condensed peat, for which a special machine was devised; (3) peat coke made in "open retorts," th efirst commercial carbonized peat fuel produced in this country; (4) peat coke made in externally heated closed retorts; (5) peat coke made in internally fired retorts, which made possible the production of a harder coke and gave a gas rich in carbon.

The process finally developed and now used consists of the following steps:

(1) The peat is dug from dredge, or car, if the bog is drained.

(2) A belt conveyor carries it to the water separator, which extracts 30% to 40% of the contained free water.

(3) Another conveyor takes it to the condenser or peat machine, which condenses it to one-third of its original bulk.

(4) Gravity takes the macerated peat to the boring machine or tuber, which makes it into hollow cylinders of suitable length. The tubes of wet peat are caught on pallets, which, when full, are stacked on cars holding at least 3,000 pounds.

(5) The cars, when loaded, are run into drying tunnels, where the peat is dried with the waste gases from the coking retorts until it has not over 30% moisture.

(6) From the tunnel the peat is elevated to the tops of the carbonizing retorts, which are charged as often as necessary.

(7) The retorts are heated to 3,000 degrees F., and then charged with dry peat; the lid is placed on the opening and the peat loses its volatile matter.

(8) The coke is taken from bottom of retorts into cars with tightly fitting lids, and conveyed to storehouses after cooling.

(This paper will be published in a later number of this Journal.)

The meeting was then adjourned subject to the call of the Secretary to meet at Ottawa, Canada, in 1910.

JULIUS BORDOLLO,
Secretary.

Journal of the American Peat Society

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THE AMERICAN PEAT SOCIETY, A REVIEW.

President's Address, Boston Meeting.

By Joseph Hyde Pratt.

Before the establishment of the American Peat Society two years ago at the Jamestown Exposition it was difficult to obtain accurate information regarding the peat industry in this country, the location of peat deposits, the value and uses of peat, or regarding the literature of peat. Since the organization of the Society, however, on Oct. 23, 1907, and the publication of its Journal, there has been a most decided change in these conditions, and now the general status of the peat industry is kept permanently before the people, and it is possible to obtain through the Journal of the Society a comprehensive idea of the peat industry, the increase in the demand for peat products, and to obtain a digest of peat literature published not only in this country, but abroad.

I believe the increased interest of people in general for information regarding the peat industry and peat resources of this country has been due largely to the influence and publications of the American Peat Society. The object of the Society and the reason for its organization are to advance the general knowledge regarding the utilization of peat for all the purposes to which it is adapted, and to give accurate information regarding its occurrence, value, and the methods of utilizing it.

It is natural that as the extent of our vast deposits of peat are brought to the attention of the people of this country and authoritative information is given as to ways of making use of them, investors who are interested in the development of the natural resources of the country, and in the possibility of building up new industries should be attracted to these peat deposits as a means of investment.

As we are all aware, the uses of peat are manifold, and as the years go by, these will probably increase still more. In this country, however, the commercial uses are not very numerous due partly to the fact that we are abundantly supplied with other natural resources that can be used for the same purposes. There are three uses of peat, however, that should be developed in this country to a very considerable degree, even at the present time. These are: 1st, for fertilizer purposes; 2nd, as a fuel, and 3rd, as stable litter. I believe that it will be found that these three uses of peat can and will be developed to a large extent in this country and that upon them will be built up commercially important industries. There are a number of reasons why I have this opinion, and it may be of some interest to the Society to give them here.

Peat for Fertilizer Purposes: A great many experiments have been made to determine the chemical composition of peat, and these have shown that it is quite valuable, containing when wet from 85-90 or more per cent of water, 8-13 per cent of combustible matter, and about 2 per cent of mineral matter. Occasionally the water content of freshly dug peat may be as high as 95 per cent. The combustible matter consists of Hydrocarbon and Nitrogen Compounds. As the peat is dug from the bog and left to dry on the bank it loses nearly one-half of its water content within a few days, and if left for some time longer exposed to sun and wind, it can be reduced to from 15 to 25 per cent. The nitrogenous compounds occurring in peat are for the most part insoluble and therefore not available directly for fertilizer purposes, and many mistakes have been made in attempting to use the peat directly for its nitrogen content, which in many peats is as much as 2 to 3 per cent of combined nitrogen. This nitrogen, however, can be made available by certain chemical reactions, so that it forms soluble salts, and thus becomes of value as plant food. For home consumption by the farmers whose land is in the vicinity of the peat bogs a good plan is to dig out the peat and allow it to remain on the side of the bog for some days or weeks and then haul it to the farm, compost it with barn yard and stable manure. After standing about six months, it will be found that reactions have taken place forming soluble nitrates, thus making the nitrogen salts soluble. This is a simple method of utilizing peat as a fertilizer, and our farmers should find it of considerable value to them, inasmuch as the other part of the peat which is composed largely of organic matter will be just so much humus added to the soil to make it light and porous.

Powdered peat is being used as filler for artificial fertilizers,

and in some instances it is called an adulterant; but to my mind is not in any sense an adulteration, for the reason that in artificial fertilizers there must be some filler, and in the state tests of fertilizers it is only phosphoric acid, nitrogen, potash, etc., that are determined, and these constitute but a very small per cent of the total bulk of the material sold. When the balance of the fertilizer may be is often not even known by the inspector and thus he cannot say whether it adds any value to the soil or is simply a neutral substance. For instance there are many thousands of tons of graphite mined in the United States, that are used in the manufacture of fertilizers, its use being to give a dark color to the finished fertilizer compound. This material has absolutely no beneficial properties when added to soil, and is only worth about $2.00 per ton when mined, but is sold in the fertilizer at many cents per pound—a pretty nice profit to the manufacturer of the fertilizer. The peat assists in giving the dark color to the fertilizer, which the market seems to demand, but it also adds some beneficial materials to the soil as additional humus. Its nitrogen content can also be made available by reacting with certain chemical compounds, as uric acid. In the preparation of fertilizers, utilizing slaughter house refuse, etc., which are rich in nitrogen compounds, the peat keeps this material from decomposing and also by its deodorizing qualities makes it possible to ship such nitrogenous fertilizers without their having a strong odor.

Mr. Charles A. Davis states* that "Objection has been made by agricultural chemists that the nitrogen of peat is not at once available for plants, and hence the peat filler should not be used in fertilizers as it makes the nitrogen content appear higher than it really is."

Even if no attempt was made to make the nitrogen content of the peat available, it is still but a very small amount as compared with the regular nitrogen in the fertilizer, and it would not add any very large error to the nitrogen determination. On the other hand, however, a part of the nitrogen of the peat is available at the time the fertilizer is used, and all of it can be made available. I heartily commend its use as a filler, and can see no valid reason for objections to it on the part of the agricultural chemists, and as for the consumer, I should think he would much rather pay for peat than for graphite.

Powdered peat is also put on the market by itself as a fertilizer and sold simply for humus. It is principally bought by green-houses.

These uses of peat for fertilizing purposes are constantly

*Advance Chapter, Min. Res., U. S. Geological Survey, 1908. Production of Peat for 1908.

increasing, and I believe as its value is more thoroughly recognized, and the people begin to realize that it is not an adulterant, but is really of agricultural value, that its use will largely increase.

Peat as a Fuel: While the use of peat as a fuel has not gained as much ground in the past two years as was confidently expected by the advocates of peat briquets, machine peat and peat coke, yet there has been an advance made in the study of and experiments on the use of peat for fuel purposes. As we all know, the peat briquet has many properties that make it very desirable for a fuel, and wherever it has been manufactured in this country there has been but little trouble to dispose of it, provided prices compared favorably with other fuels. All housekeepers who have ever used peat fuel speak in the highest terms regarding it as it is a clean fuel; can be made to burn slowly or rapidly as desired and is very easily handled. I have talked with many people who have burnt peat briquets and machine peat in stoves and grates, and they have all expressed themselves as being extremely pleased with the results obtained from it and were ready to purchase the peat in quantity provided they could buy it at a price comparable with the cost of coal. Although there were five plants in operation for a short time during the past year there was only, according to Mr. Davis, about 900 tons of peat fuel manufactured. While these figures tell us that the peat fuel industry is not yet an established one in this country, it does not mean that no advance has been made in the utilization of peat for this purpose, or that the plants operated during the past year were a failure.

While I believe that some day there will be a considerable tonnage of peat fuel manufactured and utilized in different parts of this country, I am of the opinion that the principle use of peat as fuel will be found in its utilization in the gas producer, or in the manufacture of machine peat to be utilized at the bog in the production of electric current for transmitted to nearby towns. I wish to reiterate here a statement that I made regarding this same subject in my address to the Society a year ago. "It seems to me that many peat deposits are so located in near proximity to towns, that it would be possible and practicable to erect an electric plant at the bog, using the peat as the fuel and converting it into electric current which would be transmitted to the nearby towns. The peat could be used directly as a fuel, or in the production of gas in a gas producer."

We have in North Carolina a number of towns situated close to deposits of good peat, where I believe such a plant could be made a profitable investment. There are towns in

other states similarly situated that offer the same commercial advantages.

Peat as a Litter and Absorbent: As we all know, the peat best adapted for this purpose is the mossy, fibrous variety. At the present time the European countries are utilizing peat for this purpose to a much greater extent than we are in America, and I believe it is simply because they have given more thought and attention to the value of peat for this purpose, and have learned its true worth. As a litter for bedding purposes in stables, especially in cities, and in dairy barns, its deodorizing and absorbent properties make it especially desirable. When thrown out after use for this purpose, it can be made into a compost and then later used as a fertilizer, and should give good results.

I wish now to call your attention to what the peat industry amounted to in the United Staes during the past year, and compare these figures with the value of the industry for the preceding two years. The following table gives the quantity of the various peat industries in the United States during 1908:

Peat Manufactured in the United States During 1908.

Kinds of Manufactured Products.	Industry—Tons.	Value.
Fertilizer	23,000	$121,210.00
Fuel	900	5,400.00
Litter	8,905	55,414.00
Total	32,805	$182,024.00

To this there must be added 8,102 tons of peat that was imported into the United States during 1908. This makes the total value of the peat industry in the United States for the year 1908, equal to $227,438. This is not a large sum, but indicates that there is a demand for peat products, and when compared with the figures of 1906, which, as far as I can ascertain, were only about $75,000, it shows that the industry is increasing, and I believe that if the American Peat Society keeps on in its work as it has begun, in giving accurate and definite information to the public regarding the value and uses of peat, and calling the attention of capital to these phases of the peat industry that really offer the best opportunities for profitable investment, and disseminates amongst the consumers of peat products, literature relating to the real value of these products, that we will see a still greater advance made in the manufacture and utilization of these products in the next two years, than in the past two. I feel that we are just at the beginning of an era that is to see the development of large areas of rich peat deposits that are now lying dormant and producing nothing of commercial value, and I do not

refer in this remark to the development by drainage of the peat swamps for agricultural purposes.

Peat Literature: During the past year there has been a considerable addition to peat literature, and first and foremost I would place the Journal of the American Peat Society, inasmuch as this Journal, through the very efficient editorship of Mr. Charles A. Davis, has kept abreast of the work and experiments that have been made on peat, and has published many excellent articles treating on various phases of the peat industry. The Journal has also kept in touch with all the new peat plants that have been organized, and has given information regarding their location and production.

Another publication is "Peat Deposits in Maine," by Edson S. Bastin and Charles A. Davis. This publication takes up in detail the occurrences and value of peat deposits in the State of Maine, and also gives a great deal of general information regarding the formation of the deposits and the uses of the peat. It represents a model of reports that will probably be prepared by some of the other States.

Mr. Davis' article, prepared for the Mineral Resources of the United States Geological Survey, is a very comprehensive one on the preparation and uses of peat, and of its production in the United States, and is a valuable addition to the other papers he has written on this important subject.

In closing, I wish to express to the Society my great appreciation of the valuable work that Mr. Davis and Mr. Bulask, the editor and managing editor of the Journal, and Mr. Borodollo, our Secretary, have done. They have worked hard and faithfully for the good of the Society, and it is due very largely to these three men that our Society has become so firmly established as a factor in the scientific world. Its influence is being felt and recognized by all as an authority on all questions relating to peat and to the peat industry.

THE USE OF PEAT AS A FUEL IN GAS PRODUCERS.

(D. T. Randall, Boston, Mass. Read at the Boston Meeting.)

The gas producer is an apparatus used for converting solid fuels into a gaseous state. It is usually built of heavy sheets of steel riveted and calked to form a gas-tight cylindrical shell. The shell is lined with fire-brick to protect it from the high temperature resulting from the combustion of the fuel. The other features of the design depend upon the kind of producer — whether it is an up-draft or down-draft producer. In an up-draft producer the fuel is supported upon an iron grate, or in some cases by a bed of ashes. The fuel is fed at the top

and is gradually heated by the gases which pass up through it on their way to the scrubber. In this type of producer, much of the moisture and volatile matter of the coal is driven off at a comparatively low-temperature. Part of the tar formed by heating the coal is condensed when brought in contact with the cooling water in the scrubber and part of it is carried on by the gas. This makes it necessary to install some type of tar extractor in the line between the producer and the engine. The most successful type is the centrifugal extractor, which throws the tar and other solid matter to the outer edge of the extractor by centrifugal force.

In the down-draft producers, the path of the gas is downward. The fuel bed is supported upon a fire-brick grate, built in the form of an arch. The gases and tar which are distilled from the top of the fuel pass down through the incandescent bed and are broken up into fixed gases. In some cases this results in breaking down some of the gases in such a way as to liberate a considerable amount of free carbon in the form of lampblack. This gives some trouble, due to clogging the gas pipes and dry scrubber. One of the difficulties of operating a down-draft producer is due to the practical impossibility of removing the ash while the producer is in operation. This necessitates shutting down the producer at intervals of about once a week to clean out the ash and clinker which have accumulated.

The design of a successful gas producer is not as simple as it may appear from an inspection of the apparatus. It has been found that while a producer of a given size may work successfully, it is not at all certain that one of smaller size built on the same proportions would also be successful. It seems to be necessary to arrive at the proper proportions for each diameter of producer by means of numerous experiments. Many attempts have been made to design a producer which would embody the leading features of both the up-draft and down-draft producers, many of which have been failures. There are, however, now on the market one or two producers designed along these lines which seem to be successful. The advantage of such a design is that it permits of burning the tar into a fixed gas and at the same time provides for the continuous operation of the producers by suitable arrangements for the removal of ash and clinker. In such a producer the fuel is fed at the top, and the volatile gas passes down through the fuel bed to about the middle of the producer, where it is drawn off with the gas formed by the air and steam which are admitted at the bottom of the producer and pass upward through the fuel bed. This type of producer requires no tar extractor.

Producers are operated under a pressure or by suction, as the case may be. The pressure is generally produced by means of a steam blower, and the suction producers are operated either by the vacuum caused by the engine or by a special rotary exhauster which delivers the gas under pressure in the holder. The combustion in both types of producers is accomplished with a limited supply of air. Just as little of the fuel is actually burned as possible in converting the remaining portion of the fuel into gas. In most producers, steam is admitted with the air, in order to make a somewhat richer gas. The oxygen of the air, on coming in contact with the fuel, burns the carbon to carbon dioxide, and this gas is it ascends through the fuel bed is broken down into carbon monoxide (CO) and oxygen. The oxygen thus liberated again unites with carbon, and the process continues until the gas reaches the upper surface of the fuel bed, where it usually leaves in the form of CO. There are other gases formed from the distillation of the volatile content of the coal, as will be indicated in the table following. The moisture which enters with the air in the form of steam is decomposed by contact with the hot carbon, resulting in the formation of CO and free hydrogen. This gives a considerably richer gas than when air alone is introduced.

In any form of producer it is necessary to pass the gas through a washing device, usually called a scrubber. This consists of a cylindrical shell filled with coke or other material which tends to break up the current of gases and allows water to wash out the impurities which have been carried over. Considerable quantities of lamp black, tar, particles of ash, etc., are removed in this manner. In the up-draft producer some form of tar extractor is necessary, and in the down-draft producer it is generally necessary to install some form of dry scrubber or settling chamber for the removal of the lamp black and other impurities.

When burning fuel in an up-draft producer the influence of the moisture in the fuel is not of great importance, for the reason that a large quantity of it is evaporated and carried off by the escaping gases; at the same time a considerable quantity of moisture is added with the air which is admitted at the bottom of the producer. The moisture thus added often amounts to one pound of steam per pound of combustible in the coal. When wet fuel is charged in a down-draft producer, however, the moisture must be vaporized and carried down through the incandescent fuel. When the moisture is high, it tends to reduce the temperature of the fuel bed and results in an unsatisfactory operation of the producer. The writer is unable to state just what the limiting percentages of moisture

may be, but it seems probable that fuels would be more satisfactory which contain less than 30 per cent. of moisture.

When peat is first removed from the bog it contains large quantities of moisture, as will be seen from the following analysis. After being exposed to the air for a considerable time, it still contains 25 or 30 per cent. moisture. Peat in this state is a satisfactory fuel for either type of gas producer and gives practically as good efficiency as bituminous coal when the heating values of each fuel are compared.

There are at the present time very few, if any, gas producers operated with peat as a fuel in this country. There are, however, some plants being operated in other countries with good results. The peat is dug by hand or by suitable machinery and allowed to dry by exposure to the atmosphere, other methods of drying having proven too expensive. In most cases the peat from the bog is passed through a machine which breaks up the fibrous structure and forms the peat into brick-like shapes. When these pieces have dried sufficiently, they are broken up into smaller pieces, either by hand or by crushing machinery, and fed to the producer in the same manner as other fuels.

About one year ago, Prof. R. H. Fernald, consulting engineer for the gas producer tests conducted at the U. S. Geological Survey testing plant at Pittsburg, visited a number of gas producer plants in Europe, and among these he found a few using peat as fuel. A plant in Sweden was of especial interest for the reason that the power plant was located at the peat bog, some three miles from the city, and about 300 kilowatts alternating current transmitted at high voltage to the city. The peat in this case was dug at convenient times, passed through a machine and allowed to dry on the ground. It was then crushed to a suitable size before being fed to the producers.

In connection with the investigations on peat, the technologic branch of the United States Geological Survey has conducted some gas producer tests, using machined peat as a fuel. The results of these tests were quite favorable, and the results are of interest as indicating the possibilities of utilizing this fuel for power purposes. In a test made at St. Louis on Florida peat the following results were obtained:

Peat from a Bog Located at Orlando, Orange County, Fla.

Chemical Analyses.

	As Dug from Bog.	As Used in Producer,	Ultimate Analysis Dry Basis.	
Moisture	92.41	21.00	Hydrogen	5.18
Volatile Matter	4.68	51.72	Carbon	57.77
Fixed Carbon	2.58	22.11	Nitrogen	2.89
Ash	.33	5.17	Oxygen	25.20
			Ash	8.37
	100.00	100.00	Sulphur	.59
Sulphur	.05	.45		
B. t. u.—8127.				100.00

Results.

The Producer test was conducted for a period of 50 hours with the following results:

Average electrical horse-power developed	205
Average B. t. u. cu. ft. gas	175.2
Total fuel fired, pounds	29,250
Equivalent fuel used in producer plant per electrical horse-power commercially available, pounds	3.16

The fuel used in the above test after being dug was passed through a machine which destroyed the fibre, after which it was passed to a molding machine and formed into bricks 4"x 8"x 2½". These bricks were placed on boards and hauled in wagons to an open field, where they were allowed to dry to 20% or 25% moisture. The moisture in the peat when used in the producer was 21%, as will be noted from the above analysis.

This test was conducted on an R. D. Wood pressure producer of the up-draft type and a Westinghouse Three-Cylinder Gas Engine of 250 H. P. capacity.

Tests were also conducted at Pittsburg during the past year on peat from North Carolina which was prepared and dried at the Fuel Testing Plant at Norfolk and sent to Pittsburg for tests at a later date. This test was made on a down-draft producer with satisfactory results.

Peat from North Carolina.

Chemical Analysis of Peat.

Moisture	13.88
Volatile Matter	36.64
Fixed Carbon	21.70
Ash	27.78
	100.00
Sulphur	1.17
B. t. u. as fired	5974

Composition of Producer Gas by Volume.

	Per Cent.
Carbon Dioxide (CO_2)	10.94
Oxygen (O_2)	.41
Ethylene (C_2H_4)	.06
Carbon Monoxide (CO)	16.91
Hydrogen (H)	10.19
Methane (CH_4)	.66
Nitrogen (N_2)	60.83
	100.00
B. t. u. cu. ft.	109.7

Results.

Duration of tests	13.48 hours
Total fuel fired	5925 pounds
Cubic feet of gas per lb. of fuel fired	31.2
Electrical horse-power generated	110.3
Fuel consumed per hour per electrical horse-power commercially available, pounds estimated	4.11

Unfortunately during the test a casting connecting the producer with the economizer cracked and interrupted the testing for a considerable period until repairs could be made. After suitable repairs had been made the test was continued. The peat burned freely and the gas was of fair quality, but, owing to the loss of fuel during the time the plant was out of repair, the amount of fuel burned to produce a given amount of gas was of necessity estimated, and for this reason there is some doubt about the true performance of the fuel. However the estimate is considered to be as close as possible to the facts, and the results, while not scientifically correct, are of value and indicate what may be expected from peat in this type of producer.

It will be noted that the fuel used in this test was very high in ash. Better results, of course may be expected from fuels which are lower in ash and higher in heating value. These tests indicate that for a fair quality of peat, power may be generated without difficulty in a gas producer plant and the cost of power will be governed very largely by the quality of the peat and the cost of digging and drying it to a condition suitable for use in the producer.

Fuel Laboratory, Arthur D. Little, Inc.
Boston, Mass., Sept., 1909.

THE STARTING POINT OF PEAT FUEL UTILIZATION.

By H. Garnett and Francis J. Bulask, of The Peat Engineering Co., Toledo, Ohio.

(Read at the Boston Meeting.)
(Revised.)

The United States government has been surveying and testing for fuel value the vast swamp deposits of Maine. Surveys have also been made in the states of New Jersey, New York, Michigan, Indiana, Iowa, Wisconsin, Connecticut and Florida by the respective states, either independently or assisted by the government. The result is that vast areas of valuable peat fuel deposits have been located and tabulated.

Those who have followed the history of the numerous attempts to utilize this fuel in a commercial way, will have been struck with oft recurring notices in engineering and technical papers describing some new process of Peat-Fuel manufacture, and of the formation of heavy capitalized companies to purchase patent rights to operate some newly devised scheme which was supposed to solve this very important question.

Space will not permit a lengthy description of the methods adopted to eliminate the 90% moisture contained in the peat as excavated, and to dry this material down to 20% when it is fit for fuel, but they may be briefly summed up under three heads: "Briquetting," "Mechanical Extracting" and "Air-Drying."

Briquetting has been attempted in numerous instances in this country, but the same difficulties experienced in the mechanical extraction of moisture are again met with. The factories which have given the most promising results, have air-dried the peat on the bog in a fine condition after excavation by mechanical means. This air-drying reduces the moisture to about 40%, in which condition the peat is conveyed to factory, further pulverized and passed through dryers, until the moisture point does not exceed 10%. The peat is then briquetted, under enormous pressure and great expense.

The fuel thus produced is neat in appearance but is useless for cooking, or gas making processes, as it rapidly disintegrates during combustion, liberating large quantities of fine, light ash which is objectionable in gas making.

There are only four peat briquette plants in Europe which, owing to the high calorific value of the peat used, are able to show an operating profit, but so far this method has proved unsuccessful in this country.

Mechanical Extraction of the moisture has been tried years ago in many countries and enormous sums have been expended by governments and private individuals to devise some method whereby the water might be forcibly ejected, but the best results so far attained are so discouraging that it will be well for those attempting these methods to thoroughly investigate what has been done along this line, before investing any money in experimental work, which in all probability has been proved futile years before; but in spite of the fact that even under enormous pressure, the chemically combined or latent water cannot be expelled below 65%, from which point artificial heat has to be employed, we continually hear of some new process claiming to satisfactorily accomplish this end, and, while admitting there is no finality in mechanical devices, there is not a factory in successful operation in this country.

Air-drying is the only successful method used in the older countries, where in some localities peat is and has been the only fuel for centuries. At first the peat was dug by hand and left on the swamp to dry, being turned and stacked as experience proved most economical. Later, machines were devised to macerate and condense the wet peat to facilitate the drying and transportation, and there are now hundreds of these simple, inexpensive machines in operation during the summer months, making a good quality of hard, dense fuel nearly equal to soft coal.

Ninety per cent of the peat fuel used in the world which has been mechanically treated to improve its bulk and render it fit for transport without loss, is made by the "Wet Process" or "Machine Peat." The fact that this is so, renders further explanation of other processes needless, but as the true principles of the change which takes place between raw peat and machined peat are not fully understood, it may be well to look into the question more fully.

Those who in this country have attempted the conversion of this wealth into serviceable fuel, have not taken time to study the all-important question, "What is peat?" but have gone blindly groping around, trying all kinds of devices to extract the moisture by forcible means at great cost, when the sun and air will do all that work free of charge.

Without wearying you with too much reference to the chemistry of peat, which is outside the scope of this paper, we will note briefly the reason why this method is and always has been the most successful known for peat-fuel making.

Most vegetable matter contains cellulose in varying quantities, and in proportion as its celluloses are attacked by destructive agencies, the residue tends to constitute itself into a complex of increasing resistance, and so the chemistry of the

vegetable world, which depends in its proximate relationships upon the properties of polyhydroxyl derivatives of the carbon unit, is ultimately a most striking manifestation of the properties of the carbon atom itself. But while these changes are taking place, so also are numerous others, the chief being the formation of the hydrate, which is the chief chemical agent brought into play in air-drying peat. It is a property common to all plant life, and on the plant's maturing, it changes its composition and forms "pectic acid." So long as the peat remains undisturbed, this pectic acid acts as a preservative, and, together with the water always present, prevents the actual decomposition of the plant remains and permits of their consolidation.

The secret of successful peat-fuel machinery is to so treat the chemical agent, pectic acid, so as to liberate it from the sides and the pith of the plant remains and thoroughly mix the acid properties through the wet peat mass — no water being extracted during any stage of the process. After the peat has been thoroughly macerated, it should then be spread in convenient layers — say four to six inches deep — on the surface of the bog from which it was taken; not on boards or racks, or wire netting or bricks, screens, or run into dryers, but laid again on the bog, for the following reason:

The pectic acid is all through and around the peat block, and in a few hours time the acid begins to oxydize on coming in contact with the air. Another chemical change now takes place, and "hornoid" is formed. This "hornoid" rapidly contracts the three sides and two ends exposed to the air. During this contraction under pressure, the moisture, both loose and latent in the blocks, is forcibly ejected through the bottom of the blocks and thence into the bog. This automatic expulsion of the moisture takes place as long as the air is dry enough to evaporate the water from the surface and keep the partially formed "hornoid" hard enough to contract the blocks, but when the dew falls, the "hornoid" is again softened, but the block having gotten very much compressed during the day, continues to give off its water freely all through the night, the result being that the drying is continuous for twenty-four hours. However, should attempts be made to artificially dry peat fuel before the above mentioned chemical changes have taken place and nature has done her part in her always perfect way, the result can only spell failure, the reason being that peat blocks must be dried from the center outwards, and not from the outside inward, to keep them from checking, etc.

The next question that suggests itself is, "What method of 'wet processing' peat is best and most economical?" In answer thereto it might be said that 90% of the peat-fuel manufactured in Europe is made by portable self-contained plants,

situated right on the bog at the edge of the excavation. The fuel thus produced is considered by experts superior to all other forms of peat-fuel. The process is simple, requiring few men to operate; the plant inexpensive in first cost and maintenance, and, as American requirements of peat-fuel are not more exacting than in other countries, there is no need for further experimental devices, as the problem is already solved.

Owing to climatic conditions, the nature of the flora and the more perfect decomposition of American bogs, the fuel made therefrom should be produced at approximately the same cost per ton as that made from European peat.

A complete plant, of latest improved design, suited in all ways to American bogs and labor conditions, which embraces all of the good qualities of the best European machinery, should be a portable, self-propelled apparatus. Such a plant, comprising three parts, consists, first, of a steel truck mounted on apron wheels, which contains power, all driving mechanism and excavating apparatus; second, a spreader which receives the treated peat and lays it out on the bog in even layers subdivided into regularly divided blocks, and third, a winnower which later, when the peat is sufficiently dry, winnows same into a pile ready to load and convey to cars or storage bins.

In operating, these three parts travel over the surface of the bog as one machine, independent of any track, traveling along at a predetermined speed, being steered by the engineer or operator.

The machine while at work digs a trench or ditch alongside the machine. While elevating the material to the level of the truck floor it is being treated in most approved fashion. It is then deposited in the spreader immediately in rear of the machine and alongside of trench or ditch.

The advantage of the ditch above mentioned should not be overlooked, as the more a bog is ditched, the quality of the fuel produced therefrom is enhanced in proportion, and, as the prepared peat is delivered close to the edge of these ditches or drains, more rapid drying results.

On a very wet, undrainable swamp, the apparatus is mounted on a scow and the method of handling the peat somewhat modified.

In either case a great saving over all other methods, dry or wet, is effected, as the peat carrying a large quantity of moisture, is handled in a fractional part of the time of any other method. The work is all done with one handling. The peat is being dried on the best kind of drying ground, producing a less number of broken or breakable blocks; no section of tillable or other valuable land need be acquired for drying purposes, no money tied up in racks and pallets, etc.

The ditches or trenches lie parallel to each other, anywhere from 50 to 150 feet apart, and as soon as the top layer has been converted into fuel, the machine begins on the second layer, and so on until the entire bog has been converted into fuel.

It should be understood that this paper is not for the purpose of proposing any new method lately invented or developed; neither is it for the purpose of exploiting any one kind or style of process or machinery. The results, as above outlined, are capable of accomplishment in various ways and this paper is meant to be understood as outlining a most general plan, citing an instance of its easy accomplishment, for the fact remains that before **peat gas can be used for generating electric current for light and power purposes, as is done in Sweden; before peat can be converted into coke for metallurgical purposes and iron foundry work, as is done in Germany and Russia; before peat can be used as a household fuel, as is the case in almost every country in Europe, a solid, dense, hard fuel, free from excessive ash, smoke and clinker must be produced at a cost placing it on an equal basis with other fuels of corresponding thermal value.**, and, as air-dried, condensed peat is the only successful form of peat-fuel made and used in the old countries for the purposes above mentioned, is it not better for those in this country to obtain and put into practice such principles as the above and obtain for themselves all information regarding this simple and inexpensive process, so long the accepted method, to the exclusion of all others, before investing money in any one of the many untried schemes which are constantly being projected?

THE MALLOCH PEAT DRIER.

(Dr. J. McWilliam, London, Ont. Read at the Boston Meeting.)

This machine is a device to dry peat dust, collected by the Milne or other process, from 30 per cent. down to from 8 to 15 per cent. It uses the exhaust steam from the engine, also the gases from the smokestack; and if this should not be sufficient to dry the peat in the quantities required, then live steam from the boiler can be added.

The drier consists of a series of pans 1½ inches deep, made of ⅜-inch iron plate, rivited so as to hold live steam at 100 pounds pressure. These pans may be in any number, and are 20 feet long by 3 feet 6 inches wide. They are placed 10 inches apart, one on top of another, and the peat dust is carried over them by iron rakes shod with wood notched on the lower surface, and carried on chains borne on sprocket wheels at each

end and driven by gears. Between the pans is a series of 2-inch steam pipes also filled with steam and connected at each end by a header. The whole drier is enclosed in a 13-inch brick wall. It delivers the peat to the briquetting press at a temperature of 170 to 200 degrees F. The gases from the smokestack are driven through the drier by a fan, sparks being arrested by two wire screens in the conveyor pipe.

This machine has been built and is now being tested at the peat fuel plant at Dorchester, Ontario. It was only ready to run a week ago (September 15, 1909), and has not yet had a day's run, owing to defective working of minor parts, but the trial made is most encouraging. The points noted in its favor are that it practically does the work for nothing, using the heat of the exhaust steam from the engine and smoke from the furnace; that it does not superheat the peat and thus deprive it of some of its calorific value; that it is easy to operate, requiring very little power; that it does not catch fire; that it does not waste the peat dust; that it delivers the peat dust hot to the briquetting press.

THE PRESENT STATE OF THE PEAT INDUSTRY OF EUROPE, ESPECIALLY IN GERMANY.

(Dr. Fritz Heber, Gelsenkirchen, Germany.)

The enormous consumption of coal for industrial purposes is a continual menace to manufacturing and transportation of all Europe on account of a visible approach of exhaustion of this indispensible raw material.

For many years engineers and scientists have been investigating the use of low grade fuels for generating power, and it is a well-known fact that the flourishing lignite or brown coal industry in Germany is due to engineering science. Lignite furnishes power to whole provinces of middle Germany and by the latest victory of the so-called Mond gas process, the lowest grades of bituminous coal, even the Halden coal, up to this time entirely valueless, are advantageously employed in many industries.

The fact that the great peat deposits of Germany have not hitherto been utilized for industrial purposes on a larger scale was due in part to the difficulty of transporting it to distant points and in part to the impossibility of inducing factories to locate near the bogs and utilize there the power generated from the peat.

Recently electricity has been used very extensively and is chiefly employed in those industries that do not require a particular locality, as the aluminum, the calcium nitrate and the iron industries, which, since the invention of a practicable

electric furnace by the three Swedish engineers, Groenwall, Lindblad, and Stalhane, has so thoroughly aroused the iron industry of Germany. The fear that an important part of the German business would stray away to Sweden and Norway on account of the cheap electric power developed by the great waterfalls of both countries, has caused in the last year many earnest attempts to develop, on a large scale, the great German peat deposits. Even now in Germany the possibility is being considered of establishing a gigantic industrial enterprise in the northwestern part of the country based on the Frank and Caro system of gasifying peat.

Germany is fourth among European countries in the extent of peat deposits, as is shown below:

Country	Area of Bogs in Hectares	Bog Area in Acres	Percent of Total Area
Russia	38,000,000	93,860,000	7.0
Finland	7,400,000	18,278,000	20.0
Sweden	5,198,500	12,840,300	12.6
Germany	2,837,000	7,007,400	3.2
Norway	1,600,000	3,958,000	5.8
Ireland	475,000	1,173,250	5.8
Denmark	236,000	582,900	6.2

Consequently it has in these deposits a partial substitute for its lack of water powers.

Until the present time there has scarcely been a peat industry in Germany worth speaking of as the use of peat has been chiefly a local one. At the time of the introduction of the peat machines of Dolberg, Anrep and Schlickeysen, it was generally hoped that peat would soon be transported to distant markets, but the hard question of drying the product made these hopes come to nothing. When the great success of briquetting lignite was achieved, it was hoped to briquet peat in a similar manner, but again the drying question was the obstacle to success.

Although there still exists at the present time, four peat briquetting plants, one each at Irinowka, Russia; Helenaveen, Holland; Langenberg and Ostrach, Germany, still these all are operated with little profit, and are only of local importance. In Canada also some peat briquetting factories have been erected, but with the same negative success, as I am informed, as in Germany.

Extended experiments have also been made in Germany, and especially in Russia, with the coking of peat, on which great expectations were based, but which, unfortunately, showed no great results. Various ovens for the dry distillation of peat were constructed, of which that of Dr. Martin

Ziegler must be considered the most successful. Ziegler built large peat coking works at Oldenburg, Schelecken and Beuerberg, Germany, and one large plant at Redkino, Russia, assisted by the Russian government, but all of his great enterprises failed. Even in November, 1909, the most modern of his plants, the Bavarian Coke Works and Factory of Chemical Products at Beuerberg, has gone into bankruptcy.

Dr. Ziegler has now assigned most of his patents to the Doering Syndicate of Moscow, Russia. He lately informed me that the principal reasons for his failure lay in the high cost of the recovery of the paraffin and oils, and in the costs of re-distilling the tar-water, but, above all, in the insufficient manner of drying the peat.

The drying question has generally shown itself to be the most difficult to manage in all forms of development, up to the present time, and if the coking of peat is to be worked out in a more satisfactory manner, it is, first of all, necessary to solve this extremely important question. Very recently some progress in this direction seems to have been made. The indefatigable Ziegler has worked long on the solution of the problem and as he recently told me, he has invented a water extractor which makes it possible to remove the water content of the peat without great cost. How valuable this water extractor will prove itself to be, the future must show, before it is generally adopted.

Besides this, Dr. M. Ekenberg, of London, England, has described a method of treatment, by which the peat is heated to 150 degrees C., about 300 degrees F., while under pressure of 150 atmospheres (1250 pounds per sq. in.) By this means its gelatinous (or colloidal) properties are destroyed, after which the water can be easily pressed out and the residue briquetted. Whether this method of treatment will prove valuable on a large scale will soon be shown in a plant in England. For the present, however, the process is still viewed with great mistrust by the German engineers.

The nearest approach to success with artificial drying of peat has been made by the famous Augsburg-Nuernberg machine shops, the Nuernberg Works, with their well established Gereke's peat steam boiler. By this method the wet peat, in the form of slurry, or thin pulp, is pressed by a worm slowly through a long boiler, and with the help of superheated steam under pressure of 10 atmospheres (150 pounds) is dehydrated and forced into a press which briquets it. There is an unavoidable heat loss in the distillation of the water, which is somewhat balanced by always again superheating the steam evolved as it circulates. The steam, derived principally from the peat itself, in part passes from the peat boiler down to an

condenser, arriving as hot water in a water-tube boiler. It is conducted from this, under 16 atmospheres' (240 pounds) pressure, through a small superheater, and then through a jet nozzle in which it mixes with the uncondensed, still circulating part of the steam; it is then heated in a very large regenerator by the stack gases, and then again passes, under pressure of 12 atmospheres (180 pounds) into the peat boiler. The water tube boiler is heated with a part of the briquets produced; it is in this only that the boiling hot water is transformed into equally hot steam and the latter is then superheated.

The Augsburg-Nuernberg Machine Shops, under contract with the Prussian States and the Siemens-Schuckert Electrical Company of Hamburg, has built a great electrical plant at Marcard's Moor, near Vossbarg, East Friesland, (district of Aurich in Northwestern Germany) in which this process will be used on an extensive scale.

The object of this central electrical power station is to supply power to the whole region, for a radius of 50 kilometers (about 30 miles) (principally the towns of Emden, Aurich and Williamshaven); but above all electric power for the construction of a canal system 40 kilometers (about 25 miles) long, by which the district will be drained and be made accessible. Great peat dredges will be driven by electricity in digging the canals and the mass of peat dredged out will immediately be worked up in the boilers of the power plant. This development, which, until the time when the Caro-Mond peat gasification process has reached a commercial stage, without difficulty can supply an annual production of 5,000,000 kilo-watts (6,700,000 horse-power) with the powerful machinery now installed, has required an expenditure of 3,000,000 marks ($720,000). The bog will give suitable employment for more than a century and fully use the entire output of power.

The gasification method of Frank-Caro-Mond, has been tested with brilliant results both at the English experimental plant at Stockton, and at the German demonstration plant at the Mont Cenis coal mine in Sodingen, but because of the well-known thoroughness and carefulness with which the Germans approach all new processes, no commercial plant for using the Caro-Mond process has yet been built. The English Mond Gas Power Company which controls the patents in England, recently erected a peat gas producer plant in Pontedera, Italy, which in the short time it has operated, with a daily consumption of 90 tons of raw peat, develops 9,000 horse power. The results attained by this Italian plant are watched for with interest in Germany.

In March of this year (1909) the Hanover Colonization and Bog Utilization Company of Osnabueck was formed under the management of the Deutsche Bank and the German Mond Gas and By-Products Company, as chief exploiting company of the Caro-Mond process, which only awaits the outcome of the Italian experiment, before going ahead in its turn to build a plant. The company with this in view, has already bought two extensive bogs near Papenburg and Osnabueck.

Although as yet no plants exist in Germany except the experimental one at the Mont Cenis Mine in Sodingen which is used in great measure for the gasification of peat by the method developed by Frank-Caro-Mond, it is now hoped that in the coming year an extensive development will be started, especially since the invention of the electric smelting furnaces and the building of numerous electrical smelting works on the Norwegian water powers.

THE WOLTERECK AMMONIA PROCESS AGAINST THE FRANK-CARO GAS PROCESS.

(Dr. Otto K. Zwingenberger, New York.)

Of all processes for the utilization of peat from the higher industrial standpoint, the gasification of peat and the manufacture of ammonia by wet combustion, certainly have the best chances according to the present state of affairs. The gasification will have some day a great success because the capital invested in such an enterprise does not need to be so enormously large as in the other branches. The manufacture of ammonia from peat by wet combustion certainly belongs to the class of industrial enterprises requiring a large amount of capital for investment, but if its promoters are right, it will have the one advantage that it works up a peat with about 80% of water. Whether the Frank and Caro process is really such a great improvement in the gasifying of peat depends on the condition on which the gas process plant is to be erected, and one may justly say that in nine cases out of ten the plain gas-producer, with or without recovering by-products, having certain modifications necessary for peat, will fill the conditions of both the practical and economical side. Several items connected with this process allow it to be carried out only on a large scale, and the fate of the Mond gas-producer, to be erected only in some few plants all over the world, will certainly be shared by the Frank-Caro process. In most cases where the gasification of peat will come into consideration, only plants of smaller size

will be needed, and for these the Frank-Caro process will be too expensive. Years ago Mr. Frank prophesied to Mr. Martin Ziegler that his coking process, for which this man certainly must be allowed some credit, would have great difficulties in developing into a great industry, but he hardly was aware enough of the facts that many of his reasons he was trying to launch in German papers against Mr. Ziegler may be just as well applied to his process. It is claimed for the Frank-Caro process that one could successfully burn up a peat containing up to about 50% of water. Anybody will believe so, but there is no denying the fact that the use of such a peat will have many shortcomings, especially in view of the fact that the Frank-Caro process needs a great quantity of steam to turn the nitrogen into ammonia. The presence of such a great quantity of water in the peat used however, leads to a low temperature in the gas-producer and consequently to a medium quality of gas, owing to a high content of CO_2 in the off-going gases, and this low temperature will keep on falling by the use of much steam. Messrs. Frank and Caro told some years ago about their success, but at present it seems that the matter is still in the primary stage and many of their promises have yet to be fulfilled. The output of ammonia of 75-80% of the amount to be had from the combined nitrogen in the peat is certainly to be appreciated, but when one considers on the other part that they have to sacrifice about one-half of the produced gas in order to superheat the steam, this sacrifice seems to be a high price for the ammonia; furthermore, the whole plant needs a great amount of apparatus for obtaining the ammonia, and the evidence that the Frank-Caro process will pay only on a large scale is proved clearly enough, as only on a large scale will the saving of wages in the by-products plant justify such an installation.

If one compares now the Woltereck process, one has to say right from the very first that it is no competitor for the gas-producer, for in this process no gas is produced at all. The Woltereck process is exclusively a chemical process for the manufacture of ammonia, with one or two by-products in smaller quantities. A lively discussion between Woltereck as one party and Frank and Caro as the other has arisen, in which they claim advantages for their respective processes over the other.

In the Woltereck process wet peat of about 75% of water is contained in a retort which is heated up to about 450 degrees centigrade and into which superheated steam and air is introduced to burn up the peat under certain conditions, and the by-products are collected in receiving vessels the details of

which need not be described. The critical point in the whole discussion is that the amount of ammonia obtained by the Woltereck process is higher than the content of nitrogen in peat would admit of. Woltereck now claims as a special merit of his process that not only the nitrogen of the peat is converted into ammonia, but that also the nitrogen of the air participates in the reaction, the peat, in the form it takes during the process, acting as a certain contact substance. Now such a reaction is by no means impossible, but Caro claims such statements of Woltereck to be due to an illusion and that the facts set forth as the results of Mr. Woltereck's experiments must be erroneous. The discussion has taken a pretty lively character and in the heat of the fight even claims were made against the proper ownership of Frank and Caro in their process. The spectator, interested in nothing but in the pure facts, certainly gets the impression that both parties are still very much in the experimental stage with their processes, for though the reports of Woltereck are made quite positive, the technical man wants to have some detailed specifications allowing him to determine the rentability, as the Woltereck process also involves the investment of a considerable amount of money, like the Ziegler process, etc., and the experiences with one retort, even when successful, do not allow one to establish the rentability of this process once and for all.

Woltereck gives in his report just one figure for the cost of manufacturing of one ton of ammonia sulphate, but that one figure is not satisfactory enough, for there are, even with the Woltereck process, several points which still need more interpretation. Woltereck says himself that he uses great quantities of steam, but does not give further details, and such details are always interesting where "great quantities" of steam have to be generated at a place allowing nothing but peat as a fuel.

Woltereck questions Caro pretty severely about how much produced gas he has to use for superheating the steam, but he himself is utterly silent about similar points in his process and talks a good deal relative to how much he lets out, but he does not talk about how much he blows in. To know all these details is the more interesting, as Woltereck in his heated discussion with Caro is criticising the price of peat that Caro puts in his calculation, which is about 3 marks (72 cents) per ton, and he says that he himself could not produce one ton of peat (theoretically dry), at a lower price than 4.33 marks ($1.02). A peat of 75% water as he uses is nearly nothing else but peat as it is dug from the bog. The peat is only excavated and transported over an aerial line, and it is hardly seen where the high price is coming from, when one considers

that any contractor can dig of such or similar stuff one or two cubic yards per minute with an orange-peel bucket at an expense of from 3 to 5 cents. The price of peat which Woltereck gives in his report must make anybody want more details, for that last consideration makes the statement of cost per ton of ammonia sulphate by only one figure still more uncertain.

In this question of price the discussion seems to show a misunderstanding on the side of Woltereck, for he says Caro figures in his calculation one ton of theoretically dry peat, furnished with 50% water to the spot, with 3 marks, whereas he himself with 75% water in the peat could not deliver one ton of theoretically dry peat below 4 marks 33 pfg. ($1.02).

Now Caro clearly says himself (page 153, Magazine German Peat Society), that one ton of theoretically dry peat costs him 6 marks ($1.44), which is most probably in accordance with the facts, whereas Woltereck's price for nearly crude peat is relatively very high unless this price of 4,33 marks, equal to $1.02, includes the value of the peat in regard to real estate.

However that may be, one can say that, if Woltereck is able to prove the profits he claims for his experiments, he has given to chemical industry a new and valuable process, but at present it is still in its infancy and the claims have to be proved in a more satisfactory way. Which of the two processes will get the better of the other, one cannot say at present, for the output of ammonia Frank and Caro achieve is a pretty good one, and the remaining gas may be used advantageously. The claim Woltereck makes against Frank and Caro in regard to the ownership of their modification of the Mond gas-producer we may hope to be proved wrong, for of the two men, Frank especially stands too high in the chemical industry that he would not be above occurrences of that kind, and though he is certainly not bashful in comparing the merits of his gas process with those of other processes, he certainly knows what he is talking about as he has given the chemical industry several processes of the highest economical importance. Progress means always fighting personalities; discussions of this kind require certain claims to be covered by facts in broad daylight, and we may hope before long the peat industry may derive great benefit, and it may be that we get the present from either one of the two parties, or we get it from both of them.

A PEAT GAS-PRODUCER AND DISINTEGRATOR.

The Scientific American, May 22, 1909, thus describes Col. John Jacob Astor's vibratory disintegrator, an ingenious device

which manufactures producer gas from peat, and the patent covering which will be given to the public:

"The vibratory disintegrator which has been invented by Col. Astor, and which, it is believed, will solve the problem of the commercial manufacture of producer gas from peat, utilizes the expansive force of the air and gases with the very porous peat to disrupt and disintegrate the latter and to permit the peat to be thoroughly and uniformly heated. The gas generated may be supplied to an ordinary combustion engine, the engine muffler being placed inside the gas-producer. The sides of this muffler are thin, so as to permit them to be distended and drawn inwardly upon variations in the pressure within the muffler. The edges of the muffler may be fluted, corrugated, or accordeon pleated to facilitate this relative movement of the opposite sides, and one end of the muffler is connected to the exhaust pipe.

The gas escaping from the engine cylinder after each explosion in the latter, tends to expand the muffler, and as the exhaust gas escapes from the muffler, the sides will again contract. These vibrations of the side walls of the muffler cause the successive compression and expansion of the gas within the gas-producer, and likewise the gas included in the pores and interstices of the peat. As a result the cells and pores contained in the peat are disrupted and the peat is broken up and disintegrated.

To further aid in breaking up and disintegrating the peat, and permitting of its uniform heating, the peat chamber of the producer is supported from the engine frame or base, so that the jarring and vibrating of the engine frame are transmitted to the peat.

Any suitable form of gas engine may be employed, but preferably one running at comparatively slow speed so that the successive charges of exhaust gas will have time to produce the desired expansion in the muffler. Preferably an air-cooled engine is employed and the air utilized in cooling the engine cylinder is delivered in part or in whole to the base of the producer.

Colonel Astor is now erecting a peat-fuel producer-gas plant at his country place at Rhinecliff on the Hudson, in which the vibrating disintegrator will be given a practical test. The plant, of about 150 horsepower, is to run a stone-crusher; and if the peat yields its gas, as it is confidently believed it will, it will mean an engineering advance that may have very far-reaching results.

The patent application is now pending, and on its being allowed, Colonel Astor intends to present it to the public, in the hope that it may be of wide general use."

THE NEW ENGLAND SECTION OF THE AMERICAN PEAT SOCIETY MEETS.

(From The New England Engineer, May, 1909.)

The second meeting of the New England Section of the American Peat Society was held in the Franklin Union Building, Boston, Friday evening, April 30.

O. E. Moulton, of Dover, N. H., President of the Section, occupied the chair and made the opening address. Mr. Moulton explained the general object of the American Peat Society and also the reasons for calling this meeting.

Preliminary to the annual convention of the American Peat Society, to be held in Boston during September this year, it was desired to discuss ways and means of entertaining the delegates and also to consider the advisability of holding an exhibition of peat and peat machinery in connection with the convention. Further, to increase the interest in peat and the methods of preparing it for its uses, Mr. Moulton reviewed the work to date of the New England organization and spoke in brief upon the methods of using peat as a fuel, pointing out that two lines were being worked upon, viz: for domestic use, and gas-producer power. Both, the speaker believed, were nearing solution.

Mr. John F. Schumaker, treasurer of the Section, followed as a speaker. He confined his remarks more or less to the possibility of using peat for gas-producer power, giving many reasons, proven to be correct both in theory and practice, showing the possibility of solving the problem to the great benefit of industrial New England, where such abundant quantities of high-grade peat are found.

Mr. H. W. Buhler, consulting engineer, who has for years been investigating and experimenting with peat for fuel purposes, both in European countries and on this side, greatly interested the audience by a careful comparison of conditions in other countries and those existing in New England. The greatest obstacles which have been encountered to date in this country have been due to the comparatively low price of coal and high labor costs.

To make a final success of the use of peat here it will require the perfecting of machinery which will compete with the low cost of peasant labor obtainable in the European countries, where the use of peat has become an industry. Mr. Buhler explained the various methods used for drying the peat after it is taken from the bog, but stated that the most successful, even today, was that of allowing the sun to do the work.

Mr. Wilbur F. Goodrich, secretary, made an appeal for greater co-operation of the members and invited others to join.

The interests of the New England Section of the American Peat Society were advanced and it is proposed to continue the work, creating a greater and wholesome agitation in the subject among the public-spirited people of New England.

NOTES.

A New Peat Manual — "Commercial Peat, Its Uses and Possibilities," by E. T. Gissing, published by Charles Griffin & Co., Ltd., Exeter street, Strand, London, W. C. This handsomely illustrated book of about 200 pages has just appeared, and cannot be adequately reviewed in this number. It is intended to extend and supplement the work, "Peat, Its Use and Manufacture," by Björling & Gissing, reviewed in the July number, and contains a well illustrated account of the most recent Europen development in peat utilization. The excellence of the plates and of the presswork, as well as the extent and varied character of the information which it contains make this book a welcome addition to our library of peat literature.

The Plant of the Alphano Company at Great Meadows, N. J., was partly destroyed by fire on the morning of December 23. The fire started in the storage bins and probably was caused by storing the over-heated and dried peat before it was sufficiently cooled.

The burned buildings will be rebuilt at once and many improvements suggested by past experience will be incorporated in the new construction. This is the pioneer peat filler plant of the United States and one of the largest manufacturers of high grade humus products. Mr. J. N. Hoff, Vice-President of the Eastern States Section of this Society, is Manager of the Alphano Company.

Smaller fires have been reported from filler plants in Pennsylvania and Ohio, and it is apparent that the problem of guarding against this peril, where peat is artificially dried, as it must be in making fertilizer filler, is a very serious one.

Mr. C. M. Crouse, of Syracuse, N. Y., and a party of friends made a trip to the Great Lakes region in October, stopping at various points, among others, where peat plants were located. It is in this way only, that those interested in the development of peat utilization can learn of the actual progress that is being made by others.

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EDITORIAL NOTES.

The Peat Exhibit of the New York Section. The plans for a peat show at the Chemists' Club, New York City, are progressing favorably and the rooms have been secured for the middle of May. As already announced. all kinds of peat, peat fuel, fertilizer filler, peat litter, fabrics, paper, peat coke and charcoal, chemical substances derived from peat distillation, and all other products made from peat, together with models, photographs, patents, cuts and blue prints of plants, machinery and tools for harvesting and utilizing peat in any way, and in any country, are desired.

It is also hoped to show books and other literature on peat and its utilization, and publishers and others who have issued such matter, are earnestly requested to send copies of their work for exhibition. All members of the American Peat Society who manufacture, are urged to send the very best samples possible of their peat and its products, photographs and illustrations of the machinery used to prepare it, and any other material that they are willing to give, or loan, for this

exhibition, securely packed by mail. In packing peat specimens, for shipment by mail, there is no way in which they can be so securely sent as to wrap them in paper and enclose them in a cloth bag, either one made specially of common sheeting, or such a one as is used for containing specie, shot, salt, sugar or other commodities. The label for such parcels can be attached to the string used to tie up the mouth of the bag, and should contain the name and the address of the sender, in order that credit may be given him on the exhibition label. All material for this exhibition should be sent as early as possible, plainly addressed to Dr. Chas. F. McKenna, 50 Church St., Kingsbridge, New York, N. Y.

Work for the Winter: It has so often been stated that the harvesting of peat is a summer pastime, that many of those who have plans, or plants, for making peat products appear to think that there is nothing that can be done during the winter, except to close down and wait for the next season.

It is especially true of the inexperienced peat worker that he begins to make plans to equip his plant about the time when he should really have it all ready to start operations. If new machinery is to be installed, it should be ordered, delivered and set up during the winter or early spring, before the ice is gone, since, if this is not done, it often happens that high water, bad roads, rains and difficulty of procuring labor in the spring delay operations of construction until the summer drought, when the work of making the product should be going on at the most rapid rate and at least cost, hence the season's product is discouraging in quantity and may be poor in quality.

If the manufacturers in this country carried in stock a large amount of assorted peat-making machinery, it might be safe to put off ordering until early spring, but, if machinery is to be had at all, either it must be constructed to order, or imported, and delivery is a matter of weeks or even months, rather than days. If newly invented machinery is to be built and installed, still more time must be allowed for getting it ready for use, for machinery, however carefully designed and built, seldom works satisfactorily when first set up, and more often than not must be radically modified, or even rebuilt, before it can be made to do the work required of it and for which it was designed. Still further must be taken into account the fact that, after machinery is in place and ready to run, the men employed must learn how to make it work efficiently, so as to bring production up to a commercial basis. The time when all of these matters can be attended to with the least expense and worry is during the winter, when competent men

unpainted; the same is true of iron work, and the increased wear obtained from wood or iron thus treated, will pay for the work several times over.

Ditching, clearing off trees, digging stumps and roots and other work of similar nature can often be done at lower cost and better advantage during the late fall and early winter, than at any other time, because then the water level in the peat is lower than at other seasons, while the surface of the deposit, stiffened by freezing, will permit the use of horses at this time in places where, under usual conditions, they could not be worked.

This is not all theory. The writer has visited plants in July that were just getting machinery in place that had been ordered in the late spring; others that had not begun operations in midsummer because the water was still too high in the bogs that were being utilized; still another case was seen where the machinery was in place early enough to permit seasonable operations, but being new and somewhat complicated, the operating force had a long season of experimental work and adjustment which had hardly been completed at the time when out-of-door operations ought to cease. Not all of these plants were for making fuel, it is true, but the principle is plain, than when the season is favorable, the plant and bog should be in the best possible condition for operation and no part of the time should be wasted because of lack of preparation on the part of those who expect to make a success of handling peat for any of the uses for which it has been tried. It is only after a fully prepared plant, in which the machinery has been developed to a state of practical efficiency, handled by men trained in its use, has been given a favorable season's run under skilled management, that it is possible to tell whether a given enterprise is to be a commercial success or failure, and the time to get into the proper condition of full efficiency is during the winter. Those who plan to manufacture peat during the summer of 1910 and need equipment of any sort, will do well to order it at once and have it ready for use as soon as the advent of spring makes it possible to work the bog. C. A. D.

Peat Fertilizer Filler. At present, the largest industry based on peat in the United States, is the manufacture of filler for artificial fertilizers. As is well known, the method of manufacture is apparently simple, consisting of digging, drying and pulverizing peat of the dark-colored and more thoroughly humified types. These processes, simple as they seem, are carried on quite differently in different plants, in most of which, in the opinion of the writer, too little attention is paid

can be easily found, and when delays for any cause are not attended by reduction of the valuable output of the industry.

During the winter also, the established plant ought to be thoroughly gone over, tools and machinery examined and repaired, and, when necessary, renewed; such work will give employment to the men it is most desirable to keep at work, and will save in increased production during the next season much more than it costs. It should also be remembered that coal tar is a cheap and most excellent preservative both of wood and iron, and all wood used about the tramways, cars, platforms and elsewhere will be much more lasting and satisfactory in use, if given a coating of hot coal tar than if left to the amount of water which is handled by manual labor and dried out of the peat by artificial heat.

In other words, too much money is unnecessarily spent for labor and for fuel. If the peat is dug by hand from a poorly drained bog, only about a ninth is marketable, if the product is sold with a guarantee of but 10 per cent moisture, as is done in many cases; hence it is advisable, if not necessary, to reduce the water-content as low as possible before it reaches the drying apparatus. This may be accomplished in a number of ways, most feasible of which is drying on the cleared surface of the bog. Draining, in operations of this sort, is a very valuable means of reducing the water content, as well as improving the quality of the peat for filler, but in the dry climate of much of our country, it is very necessary to consider the danger of fire and to guard against it constantly, especially as the surface of a drained peat deposit becomes quickly covered by a dense growth of weeds, which in fall and spring are very inflammable. A fire, once started in such a drained and dry bog, may destroy thousands of tons of the best of raw material before it can be put out.

If drainage is resorted to, as soon as the peat is in proper condition, it is a good plan to cultivate those parts of the bog surface that are not in actual use for excavating work and drying, as this improves the quality of the raw material, aerates it and also tends to improve the quality, if not the actual amount, of the nitrogen compounds, which adds to the fertilizing value of the finished product. Even if no crop is raised, it would undoubtedly pay to plow the area to be worked the next summer, late in the fall, and in this way secure the action of the frost and air on the upper layers of the peat, since freezing disintegrates and decomposes the peat and makes it easier to handle the next season. Very fibrous and poorly decomposed peat is improved by plowing for more than one season, and in most years, enough of a crop of some kind may be raised the season after plowing to

pay for the work. Farming the unused parts of the bog where peat is to be used for filler should always be considered as a possibility, and, in many cases, that used for fuel may be equally well treated in the same manner, as only the upper stratum, which would be rejected in any case, will be much affected by the cultivation. C. A. D.

Michigan Peat Company. An Eaton Rapids (Mich.) dispatch to the Lansing State Republican, dated December 28, 1909, states that, under proceedings instituted by the trustee, J. F. Hall, the entire plant of the Michigan Peat Co., located near Eaton Rapids, was sold at chancery sale on that date for about $17,000. J. A. Harkness, President of the company, bid in the property in the interest of the bondholders. The dispatch further stated that it has not yet been decided just what will be done with the plant, but it is likely that the Ann Arbor Chemical Company, which has been operating it under a short term lease, for the production of peat fertilizer filler for the past few months, will continue for a time at least.

These proceedings end one of the most notable of the failures of American peat experiments. The plant was designed to make peat fuel by an electrical process, and was equipped with permanent concrete buildings, high grade boilers and other equipment, costing, according to various reports, over $200,000.

The electrical process of extracting water proved to be worthless, and, after a number of attempts to modify the plant, so that other methods of treating peat could be used, in the hope that the invested capital could be made remunerative, operations were suspended, and the legal proceedings noted above appear to form the last paragraph in the history of this company.

Peat Fertilizer Filler Plant Burned. During the late summer, the peat filler factory of the Springfield Filler Company, at Manito, Ill., was destroyed by fire. This was one of the large producers of peat filler and humus fertilizers of the country and it is gratifying to learn that a larger, new and improved plant is in the course of construction to replace that which was burned.

The National Peat Products Company was recently incorporated at Wilmington, Del., by L. M. Hart, New York City; J. H. Grant, Yonkers, N. Y., and B. S. Wilford, Brandford, Conn. Capital, $1,000,000.

Peat Fuel in Indiana. From a newspaper item comes the report that Mr. John Banks, living about six miles west of Bristol, Ind., has begun the use of peat fuel. This report says he has prepared a supply of cut peat for his own use during the winter, and is seeking to introduce its use among his neighbors.

Use of Cut Peat Under Boilers. Cut peat is a poor fuel for use under boilers constructed for the use of bituminous coal. The fire-box of such boilers is too small to give anything like the rated steaming capacity with the low-grade bulky cut peat. In addition, at the best, the peat has only about three-quarters of the calorific and evaporative effect of bituminous coal, and usually has considerably less than this, weight for weight, if the coal is of the best quality. While the cut peat burns well, if properly dried, the defect in its use is in the bulk that must be fed into the furnace and the constant attention that must be given the fires when the fire-boxes are not specially constructed for the type of fuel. A recently reported trial on a commercial scale, has emphasized these facts, the report being that while the peat blocks burned well, it was not possible to keep up the steam in the boilers used. Those contemplating using this kind of fuel in peat operations should have the fire-boxes built especially large, or be content to get less than rated steam capacity from their boilers.

The Florida Fuel and Fertilizer Company, John Stoddard, President, it is reported, has purchased a tract of about 200 acres of peat land on the St. John's River, three-quarters of a mile north of Palatka, Florida, and for about three months has been engaged in erecting a peat fuel and fertilizer plant, which, when completed, will be unusually well equipped for making the products for which it is designed. The plant will have an outlet both by water and by rail. The peat lies in such relation to the river that no satisfactory method of draining it can be used, and it will be dredged out from a barge and spread on the banks of the resulting canals to dry. The Palatka News states that a powerful dredge is being built for the company at Jacksonville, to be used in digging the peat. The work of construction and development of the plant is, of course, in charge of Mr. Robert Ranson, of St. Augustine, the pioneer in Florida peat development.

Public Meetings. The value of meetings in securing widespread publicity over a long period of time and wide range of territory, is shown by a clipping from the Lewiston (Maine) Journal, perhaps the most widely circulated paper in that state. Under the heading, "Peat a Valuable Substance," is an excellent, brief account of the important matters discussed at the meetings of the New York Section, held at Syracuse in the middle of May. It is hoped that several of these meetings of sections may be held during the winter.

Value of Peat. Buffalo papers, of recent date, report that Frank R. Marshall, of Denver, Colorado, who is interested in the development of peat bogs of the West, for fuel, was in that city recently, and spoke enthusiastically, at one of the hotels, on the value of peat for fuel.

The Peat Products Company, of Lima, Ohio, reports that the construction of their machinery is progressing to the stage where it can be soon installed, and it is hoped that the entire plant will be in operation next season.

Washington Peat Plant. The Spokane (Wash.) New West Trade, of November 20, 1909, states that a great deposit of peat near Ilwaco, Pacific County, Washington, is soon to be worked by its owner, F. E. Francke, who is installing a modern plant for making peat fuel. The item also states that the demand for the fuel in that region is considerable and that it is expected the industry will assume large proportions, and that the fuel will bring $7.00 per ton at the start. A news story relating to the same plant reports the deposit to be about 135 acres in extent, of good depth and that the present owner has had long experience in producing peat fuel, and says that the plant is already in operation with a demand too large to be met with the output, at the selling price above noted.

Dr. J. McWilliam, Vice-President of the Canadian Section, before returning to his home at London, Ont., after the Boston meeting, made a trip into New Hampshire. While in Dover, where he was the guest of Mr. O. E. Moulton, he gave a short lecture on the subject of the manufacture and use of peat fuel before an interested audience, to whom he imparted some of his enthusiasm. It is by the faith and energy of such men as Dr. McWilliam, and their persistence in the face of many discouragements, that will count in the final development of a peat industry, worthy the name, in America, as it has already counted in the development of the American Peat Society.

Peat Gas Producer Test. A carload of machine peat was received at the United States Geological Survey testing plant at Pittsburg, in the latter part of December, 1909. It was from the plant of Mr. P. Heseltine, at Bancroft, Mich., and was donated by him to make a test in the Loomis-Pettibone gas producer used by the Survey.

Another New Peat Company. Reports from various newspapers in the Great Lakes region announce that the different patents on a new peat machine, held by Philip Heseltine, of Detroit, will probably be, or have been, acquired by a company composed of Chicago, St. Louis and Cincinnati capitalists, which will be capitalized at above $10,000,000. The reports also state that this company will have its offices in Chicago and seek to get control of the peat bogs in Minnesota, Wisconsin and several other states. Mr. Heseltine has made no personal announcement in respect to the matter and the news items are given for what they may be worth.

Newspaper Paragraphs relating to real or alleged properties and uses of peat, are constantly reaching the editor, some purporting to originate from members of the American Peat Society. While much of this matter is of use, in that it gives definite information of the real value of peat, some of it is more or less misleading, especially where academic investigations, or laboratory products, are so enthusiastically described that the readers are led to think that the possibilities indicated by these experiments are already commercially a success. It is hoped that all members of the Society will properly qualify their statements when writing, or more especially when talking to newspaper representatives, for publication. Of quite different character are the items which appear from time to time, that show, to the satisfaction of the author, at least, because no better showing has been made by the past experiments in peat production in America, and because of the cheapness of coal here, that nothing can be expected to come from attempts to use peat deposits in this country for a long time in the future, if ever. This class of paragraphs does less harm on the whole than the other, for, while the statements may alarm the timid, they stimulate the real worker to make renewed efforts, while the first kind may cause him to waste time and money on something that has no real commercial value. C. A. D.

Fires in Peat Beds. In dry reasons, reports of fires in peat beds and swamps are frequent, and the past fall is no exception. Considerable areas in the Great Dismal Swamp in

Virginia were reported devastated by fire, timber and soil both burning. Peat fires were also reported in parts of Wisconsin, Michigan and in New England. A year ago a peat bed, worked for fertilizer filler, was fired, it was supposed, by passing locomotives and the deposit was burned down, in places, to a depth of several feet; about 200 acres were burned over and most of this area was rendered worthless. Fire once started in dry peat often burns for months and may continue to smoulder until the ground water level rises high enough to check it, or until all the peat is consumed.

Freight Committee. The action of the Society in continuing this important committee, to such time as its services are required, was wise, as is shown by the following freight charges reported to the Secretary on a shipment of 25 tons of peat from North Raynham, Mass., to East Pittsburg, Pa.

Freight to Pittsburg	$99.76
From Pittsburg to East Pittsburg	9.73
Switching charges	5.00
Total	$114.49

Such freight charges certainly will discourage those who wish to experiment with peat fuel for gas producers, or other forms of furnaces, and are clearly based on a wrong classification of the material. The freight rate on "bog peat" in carload lots, minimum weight 36,000 pounds, from Toledo, Ohio, to Pittsburg, Pa., is 10 cents per 100 pounds, or $36.00 a carload. Just what is meant by "bog peat" is not explained by the railroad authorities. Dry peat, in carload lots, is given the rate of 13 cents per 100 pounds, between the two points, or $2.60 per ton. Peat fuel cannot be shipped from Toledo to Pittsburg and compete there with bituminous coal, that is clear.

Changes of Address: E. Curtis McKenney, formerly of Saugus and Boston, now has an office in Wakefield, Mass. P. Heseltine's new address is 1413 Great Northern Bldg., Chicago, Ill. Herbert Garnett, recently of Eaton Rapids, Mich., may be found with the Peat Engineering Co., Toledo, Ohio. Mr. Robert Ranson has changed his address to Palatka, Fla.

The American Peat and Fertilizer Company, with an office at 548 Commercial Bank Bldg., Chicago, Ill., is reported to be made up of those stockholders of the U. S. Peat Fuel Company who still have faith in the future of peat fuel. This company is said to have taken over the control of some of the property of the old concern. There is no stock for sale.

It is Learned from excellent authority that Vice President Kleinstueck, missing his peat fires this fall, is already planning to operate his Dolberg peat press during the coming summer, and is looking about for a suitable location for his plant.

Plans and Descriptions of the new 1-ton, portable, low-cost peat plant, designed by the Peat Engineering Co., and advertised in the last number of this Journal, have recently been received. The design is simple and, as it requires, at the most, two men to run it, it should be an economical plant to operate. One of these plants has been sold for delivery in April, and it is expected that it will be completed and on exhibition before that time.

Peat Beacon Fires. It may not be generally known that the wonderful illumination of the Hudson River, from Staten Island to Troy, which closed the great Hudson-Fulton celebration, included thirty-six great beacon fires of peat and other inflammable material. According to a description published in a New York newspaper, each of the beacons was a hollow cone of peat blocks, thirty feet high, built on a circular pedestal ninety feet in circumference. The interior of the cone was filled with intensely inflammable material, and the fire, once started, burned for six hours, sending up a thirty-foot column of solid flame, with almost no smoke. It is understood, however, that not nearly as much peat was used in these fires as had been planned, because of the difficulty of getting the right sort in large enough quantities.

The United Peat Company, of Brookfield, Mass., nearly lost its factory near that place on the morning of December 4, 1909, by a grass fire, set, it is supposed, by a spark from a locomotive of the Boston & Albany railroad. The fire was put out by the railroad section men, assisted by nearby residents, after a fight of two hours, when it had burned to within a few feet of the factory.

New England is again the seat of active interest in peat development and while it is too early to make announcements of an authentic character, assurances have been received from all of those who were at work last season that operations will be extended during the next. Several new developments of an experimental character are being quietly arranged for, the details of which it is hoped can be published when the plans are matured.

East Lexington Peat Fuel Plant. At last accounts, the machinery of the plant of the Lexington Peat Fuel Co. at East Lexington, Mass., was running to the satisfaction of the company. This plant was the one visited, through the courtesy of the management, by many members of the American Peat Society after the adjournment of the meeting at Boston. It is a briquetting plant, the plan being to dry the peat out of doors to as low a moisture content as compatible with rapid gathering, and complete the drying in an artifical dryer before briquetting.

PUBLICATIONS RECEIVED.

During the past few weeks the following important papers have been received:

Peat Production in 1908—Advance chapter from "Mineral Resources of the United States for 1908."

The Possible Use of Peat in Alaska—U. S. G. S. Bulletin 379. Mineral Resources of Alaska for 1908, pp 63-66.

Incidental Problems in Gas Producer Tests—U. S. G. S. Bulletin 393.

Comparisons of Gasoline and Alcohol Tests on Internal Combustion Engines—U. S. G. S., Bulletin 392.

Peat Resources of the United States—U. S. G. S., Bulletin 394. Papers on the Conservation of Mineral Resources, pp 62-69.

Smokeless Combustion of Coal in Boiler Plants—U. S. G. S., Bulletin 373.

The Utilization of Fuel in Locomotive Practice—U. S. G. S., Bulletin 402.

Briquetting Tests at Norfolk, Va.—U. S. G. S. Bulletin 385.

Any of these publications may be obtained free of charge by applying to the Director of the U. S. Geological Survey, Washington, D. C.

Investigation of the Peat Bogs and Peat Industry of Canada during the season of 1908-9. E. Nystrom and S. A. Anrep, Bulletin No. 1, Mines Branch, Canada Department of Mines, Ottawa, Canada. Apply to Dr. Eugene Haanel, Director. This little pamphlet of twenty-five pages contains detailed descriptions of the bogs examined during the period covered, including the area, depth and amount, origin, character, quality and best uses for the peat contained in them. The more important deposits have been very thoroughly surveyed and tested, and the large scale maps accompanying the reports are models of excellence, and are far ahead of any in similar reports that have yet been published in the United States. Chemical and fuel analyses of the peat from the bogs surveyed, are given

in sufficient numbers to show the comparative composition and fuel value of the deposits. At the end of the report is a short discussion of the present status of the peat industry in Canada. This report should be of the highest value to the people of Canada, and especially to those who contemplate utilizing any of the bogs described.

In Engineering News for July 29, 1909, is a paper entitled, "**Fuel from Peat,**" by Dr. M. Ekenberg, in which the author gives in detail an account of his researches and of the progress and present status of the process of wet carbonizing peat, which has been developed from them. The same paper has also been received as a reprint from "The Journal of the Iron and Steel Institute," No. 1, for 1909, published at 28 Victoria street, S. W., London, England. The paper is an important one and the process produces very superior article of peat fuel.

"**The Gasification of Peat with Recovery of Chemical By-Products,**" by Charles A. Davis, appeared in Cassier's Magazine for August, 1909. This is one of the papers read at the Syracuse Meeting of the New York Section of this Society, and brings the knowledge of the subject down to the date when the paper was read.

Daily Consular Reports for November 20, 1909, issued by the Bureau of Manufactures, U. S. Department of Commerce and Labor, Washington, D. C., gives a short abstract of an article from the Irish Year Book for 1909, on the value of Irish bog lands for the generation of electric power. According to the estimate contained therein, the total calorific value of the bog lands of Ireland is approximately equal to that of 5,104,000,000 tons of coal, assuming the value of a ton of peat freshly dug, wet and untreated to be a tenth of that of coal. At least one-half the estimated quantity may be considered as ultimately available for power purposes. "Peat fuel equal to coal, could be produced in selected localities in Ireland at $1.75 per ton."

"**Development of the American Industry in Gas Works During the Last 50 Years,**" by R. W. Hilgenstock, and "Creosote Oil from Water-Gas Tar," are two papers of considerable interest to those who contemplate using peat fuel in gas producers. They appeared in The Chemical Engineer, September, 1909 (Volume X, No. 3), Chicago.

The Mining World, Chicago, December 11, 1909, Volume 31, No. 24, page 1165, under the title, "**Heseltine Process for the Briquetting of Peat,**" gives an account of the plans and machinery developed by Mr. Philip Heseltine, for making peat fuel. (Illustrated). The use of the word "briquetting" here is to be deplored, since the method described is clearly not briquetting, but a simple modification of the long-used "wet

process" of making machine or condensed peat bricks. Mr. Heseltine has informed the Editor that the article noticed above was published without his knowledge and that the Mining World will soon publish a statement to that effect, as he does not wish to have his process considered one for briquetting peat.

Fuel, Chicago, October 5, 1909, pages 744-747, "**The Production of Peat in 1908.**" Reprint of the Article in Mineral Resources of the United States for 1908.

The Story of Peat in New England, O. E. Moulton, The New England Engineer, Volume 1, No. 8, March, 1909. This is an excellent short resumé of the attempts that have been made in New England to make peat fuel, and shows, among other things, that the failures that have occurred have been due to other causes than the suitability of the material for fuel. The paper also discusses the use for other purposes than fuel and gives some notes on localities throughout the country where these uses have been tried.

The Production of Coal, Coke and Peat in Canada during the calendar years 1907 and 1908. Canada Department of Mines, Mines Branch, Ottawa, Canada. This contains a brief statement of the amount of peat fuel produced in Canada in the years 1900 to 1908, inclusive. The total amount thus recorded is 3,659 tons, valued at $11,225, of which but 60 tons were reported for 1908. The paper also gives a summary of the work done on peat investigations by the Mines Branch during 1907 and 1908, including an abstract of the results reported in Bulletin No. 1, noticed in another place.

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